NEWS IN PERSPECTIVE *SEPTEMBER 15, 1961*

MANAGEMENT VIEW

THE INDUSTRY'S KWH OUTPUT IN 1961 is now expected to exceed 1960's by five-percent or more, depending on weather conditions, EEI's electric power survey committee figures . . . "anticipating a better-than-average 52-percent second half resulting from materially improved business conditions." (Noted by the committee: the trend toward larger and larger units has reached the point where 83-percent of the capacity of electric generating equipment ordered through June—about 8.8 million kw—was in units of 150,000-kw and up, the percentage of units with ratings between 300,000- and 400,000-kw has increased to 23.8 from 20.0 as of April 1 . . . and the ratings of the two largest units on order have been upped to 900,000-kw.)

1970 POWER TRANSMISSION PLANS of the investor-owned electric utility companies, projected for the press in a NYC conference on Sept. 11, stressed the industry's capability for facilities pooling, the trend to utilizing higher and higher voltages, and of course, the record: five times the line mileage of the USSR. Such plans are part of a growth picture that anticipates a 1970 total electric plant investment of $88-billion (nearly double the 1960 figure) and annual construction expenditures of $6.4-billion (double the '54-'60 annual average). Also released to the press at this conference: a desk-top presentation of turnover charts telling the "industry's story."

A MILLION-KW SURPLUS IN INDIANA makes the proposed $60-million loan to the Hoosier co-op group a "needless" use of taxpayers' moneys, stresses C. H. Blanchar, president of P. S. Co. of Indiana, Inc. He points out that investor-owned electric company facilities valued at $26.5-million are now allocated to the service of these 17 rural electric co-ops . . . giving them all the electricity they can use at fair rates.

"ECONOMIES AND IMPROVED SERVICE" benefiting the customers are expected to result from the proposed merger of P. S. Co. of Colorado (340,000 electric customers, 325,000 natural gas) and Colorado Central Power (38,000 electric customers). Comments P. S. President Robt. T. Person: "It has long been recognized in the area that such a merger is a logical step in supplying the best possible service to customers of the two companies."

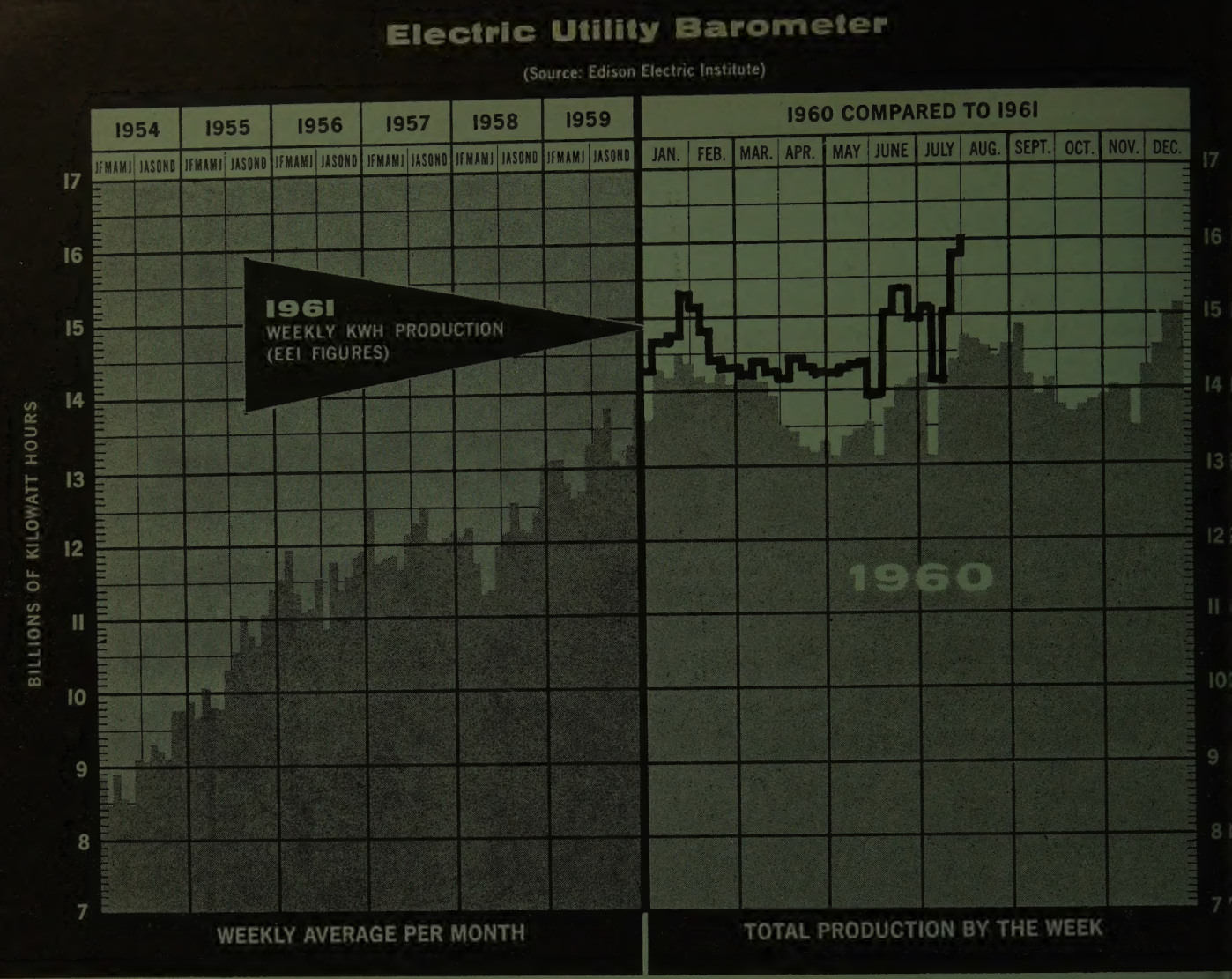
OUTAGES THAT SHOULDN'T HAPPEN somehow do . . . and no utility spokesman ever can be caught promising "it won't happen again." When Cleveland Elect. Illuminating Co. had its biggest shutdown yet last month, Pres. Ralph Besse did say emphatically that CEI will do its best to see that it doesn't happen again. But, after CEI's intertie with Ohio Power Co. passed along an overload that threw out parts of this interconnected system for about two hours, the failure raised a question about the advantage of the city's proposed intertie with the (recently interrupted) Municipal Light.

ECONOMIC CLIMATE

ECONOMIC GROWTH augurs well for the future. As things now stand, there is virtually no doubt that the U. S. will hit new peaks of output and income rates by the end of the year. For 1961 as a whole —despite a slow, almost sluggish, start —a boost of several percentage points from 1960 is indicated.

PRODUCTIVITY INCREASES have been an important factor in the improvement that has been seen in U. S. business. But this same factor has been a major contributor to the foremost economic problem besetting the country—long-term unemployment. Output per man-hour grew by about 2.5-percent last year, according to government calculations. This was less than the 4-percent recorded in 1959—a period of economic recovery —but close to the long-term average productivity increase.

The unemployment problem threatens to remain disproportionately serious.



NEWS IN PERSPECTIVE

Industrial production has clearly started an uptrend, but growth in the labor force and rising efficiency are combining to leave a hard core of long-term unemployed that will inevitably be a drag on the economy. At mid-year, there were nearly 1 million workers who had been jobless for 27 weeks or more—and at the same time U. S. employment was at an all-time high. Even fairly optimistic Administration spokesmen do not believe that foreseeable economic growth will pull the percentage of unemployed under five percent in the year to come.

CONSEQUENCE OF HARD-CORE joblessness will be seen in politics, especially in the coming election year. Efforts will be made to mount massive offensives to push through easier unemployment insurance laws, even further increases in Social Security, generous medical benefits for the aged, and public works projects to provide work for the semi-skilled and over-age.

BIGGER FEDERAL SPENDING, likely to require higher taxes from business in 1962, can be expected to reflect in more monetary inflation, inevitably.

WASHINGTON INFLUENCE

QUOTE WITHOUT COMMENT: "In other nations where socialization has taken the place of private development, governmental operation has become the substitute for regulation. With us a certain degree of socialization has already taken place. We see it in the fields of public power, of nuclear development, of international finance, of space exploration. Whether we fear it or approve it, its growth is patent."—James M. Landis, special adviser to the President of the United States.

CIVIL WORKS PROJECTS recommended by the Army Board for Rivers and Harbors include: Adoption of a comprehensive plan involving initially over $130-million in federal costs, for development of the water resources of the Delaware River Basin, including hydro power projects; federal expenditures of at least $66-million for the Oroville Dam and Reservoir, Feather River, Calif.; and construction (with a Federal outlay of over $30-million) of J. Percy Priest Dam and Reservoir, Stones River, Tenn., including a 28,000-kw power installation.

POWER CAPACITY of Army Engineers civil works dams is nearly 7-million kw, the Army reports. At the end of fiscal 1961, there were 32 projects with a generating capacity of 6,874,000-kw—up 298,000-kw (or 4.5-percent) during the year. Additional generating capacity totaling 4.2-million-kw is now under construction at two projects, in operation at 16 new projects.

GOVERNMENT CONSTRUCTION of transmission lines in the Upper Colorado is a foregone conclusion to Interior Secretary Udall. He sees "no possibility of compromise" at this time with the proposal that private interests construct this facility. Though he is "sorry to say" this, he believes it is "hard to find middle ground" among the contending factions in this matter.

REA LOANS IN FISCAL 1961 enabled co-ops to add about 116,859 new customers. There were 255 electric loans worth a total of $274.5-million. G&T loans accounted for 55.3-percent. Generating capacity of 443,286-kw was authorized by fiscal 1961 loans. Total energy production capacity of REA-financed systems rose to 2.9-million kw. REA Administrator Norman M. Clapp says the high percentage of loans for G&T purposes "indicated the need of the rural electric systems for more power, for secure power, and for power under terms that will permit the cooperatives and other borrowers to serve all the consumers in their areas at reasonable prices."

ACCUSATIONS OF REA against investor-owned utilities continue. Example: REA Administrator Clapp recently spoke of "the dual or penalty rate power contract" as "one arm of the offensive" utilities are throwing against co-ops. He noted, too, that current complaint that 2-percent loans bear an interest rate below the federal government's cost of money overlooks the fact that sometimes the government has paid less than this for funds, and said this situation may occur in the future.

CO-OP INVESTMENTS in businesses in their areas are being encouraged. Officials have lauded the actions of co-ops that have put money into private ventures in their areas. Basis for approval of investments of surplus funds—despite official position that surpluses should be devoted primarily to expansion or advance repayments of borrowings—is that new industries are good customers that contribute to the further economic development of rural areas.

NEW TVA RECORDS IN FY-'61 included an alltime high net generation of 64.5-billion kwh (74-percent steam), a system heat rate average of 9,500-Btu's per net kwh generated (under the '60 figure of 9,590), and a fuel cost of 1.766-mills per kwh.

U. S. HOUSING BILL FOLLOWUP is a new Westinghouse "total electric" home modernization program, now being pilot-tested in Muncie, Ind., in a three-month program to "focus attention on complete soundly financed home modernization by reputable dealers." (W. H. Loeber of Westinghouse explains that new home-type financing made available by the legislation will permit a family to remain in its established neighborhood, yet have the comfort and convenience of a modern kitchen and heating system in its present home.)

INDUSTRY SIFTINGS

"OLDEST" A-POWER REACTOR performing as part of an electric system, Shippingport, was shut down in mid-August for refueling of part of its nuclear fuel, after running a total of 13,706 equivalent full power hours since startup in 1957 as the nation's first fullscale project for power generation. Under construction at the AEC's Bettis Labora-

tory (operated by Westinghouse) is a new reactor core of more advanced design, which will be tested at 150,000-kw output—more than twice the output of the original core.

MUSHROOMING USE OF KWH COAST-TO-COAST is dramatically demonstrated by records such as P. S. Elect. & Gas Co.'s average of one new and bigger generator a year since 1945 (by 1965: system capacity nearly quadrupled) . . . and So. Cal. Edison's "billion dollar growth decade," ending this year.

"ELECTRICITY POWERS PROGRESS"—This theme of National Electrical Week in 1962 (Feb. 11-17) "Will help to drive home to all Americans the importance and need for continuing growth of this industry," believes the N.E.W. committee.

KITCHENLESS HOME OF 1980, depicted by the Home Economics Institute director for the U. S. Dept. of Agriculture, may utilize electricity from fuel cells. Dr. Hazel Seiberling envisions dialed meals, cold surface cooking . . . and use of gas from flexible, plug-in piping.

APPLIANCE GIFT SALES account for about half of the small-item market, LOOK magazine's survey showed. Percentagewise, biggest gift business is done in frypan skillets, mixers, can openers, shavers and blankets.

MAGNETIC BILL IMPRINTING planned by Dayton P. & L. Co. in its new data processing center is believed to be the first in the industry. A sorter-reader will read the magnetic imprinted information directly into the National Cash Register NRC 315 computer for processing. The system will handle all of the utility's record-keeping and general accounting functions, and eventually, engineering computations and studies.

AEC PERMITS ACTIONS—In recent weeks the AEC has: (1) given approval to the final design of the Con Edison Indian Point reactor; (2) considered (in a public hearing scheduled early this month) issuance of a provisional operating license for the Saxton (Pa.) Nuclear Experimental Program Reactor; but (3) withheld provisional approval of the Elk River, Minn., reactor to be operated by the Rural Coop Power Association. The latter became more of a formality, however, when the Commission's Reactor Safeguards Committee advised that the facility is "acceptable from a safety viewpoint, if no further detrimental information (such as an earlier report of cracks in the pressure vessel's stainless steel cladding) develops."

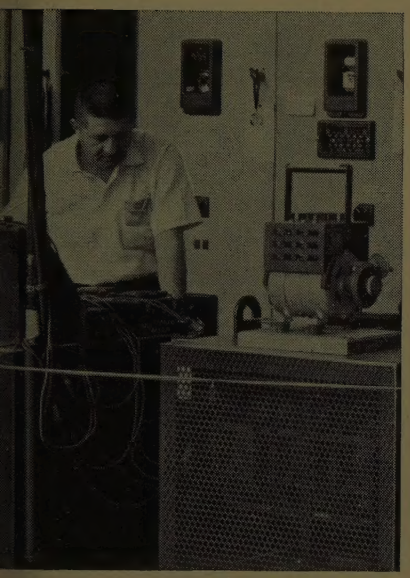
SLOW RISE IN PRICES from "low levels" of recent months was acknowledged by some electrical equipment suppliers last month. Example: the 5-percent increase on step-type voltage regulators. (But, GE dropped the price on its 196-kv TBI bushing from $3,750 to $3,150, to reflect "increased acceptance" of this standardized line.)

ALUMINUM PRODUCTION, PRICES are going up. Improved business has been requiring the use of more capacity, while wage increases and a closer look at production and material costs (by Alcoa's Rome Cable Div.) have resulted in revisions upward and downward, but mostly upward. Meanwhile, Kaiser's V-P W. C. Humphreys predicted to a House subcommittee that the aluminum industry will double in size by 1970.

MORE THERMOELECETRICITY USES in isolated regions without conventional electric power service are expected. Westinghouse, which developed a thermoelectric generator to protect a mile-deep gas well in Texas, calls such cathodic protection "an excelelnt application."

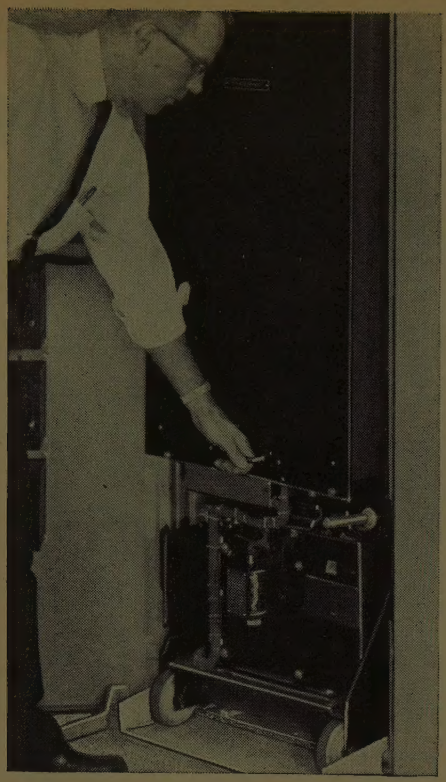
PROGRESS IN LIFE-SAVING—Most utility companies can report instances where personnel trained in rescue breathing techniques have saved lives in emergencies. (Georgia Power Co. notes that four cases of such rescues have been credited recently to persons familiar with the mouth-to-mouth methods.) And, in an AIEE meeting last month, a U. of Oregon researcher, working with such techniques as the Kouwenhoven closed-chest heart method, spoke of the possibility of one day replacing a defective heart with an artificial one.

your best buy

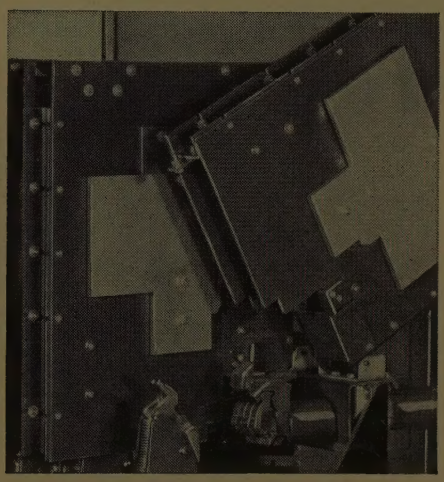


Proper component functioning is verified by a continuing program of production inspection and testing.

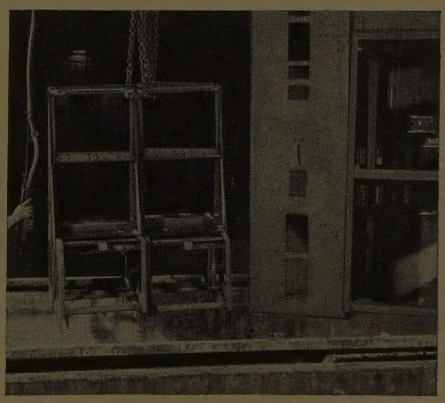
Front panel is protected during assembly, shipment and installation by strippable plastic coating.



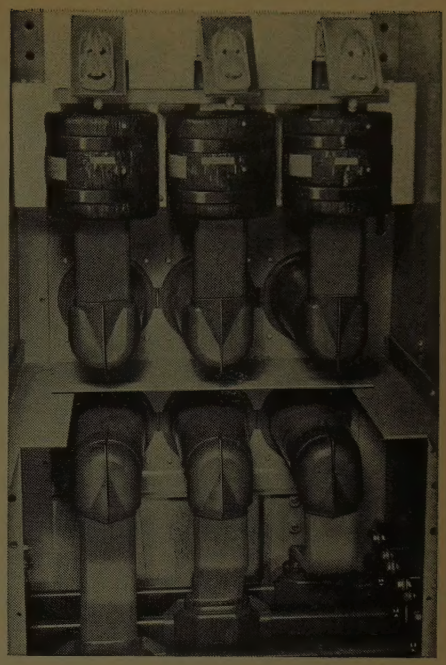
Simple, quick inspection, maintenance and replacement of DH breakers is made possible by horizontal drawout construction.



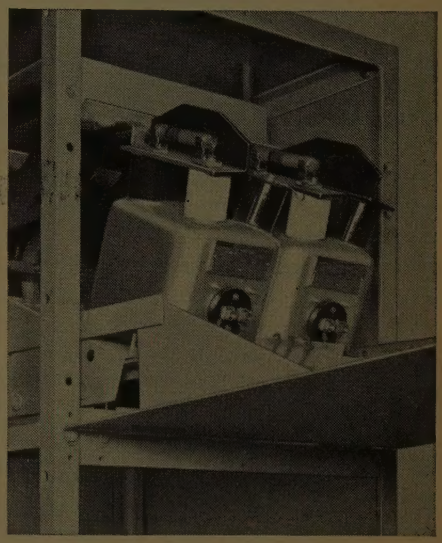
Hinged arc chute permits easy tilting for inspection and maintenance of contacts with DH breaker in drawout position.



Thorough phosphatizing and priming treatment safeguards against corrosion and provides a superior base for finish coat.



Complete joint sealing with polyester compound at main contact supports and main bus provides full insulation.



Personnel are protected by separate compartment drawout-type mounting of potential transformers.

Westinghouse

J-61014

DESIRED GENERATION COMPUTER AIDS SYSTEM OPERATION AND PRODUCTION

Any system planning installation of control should consider the many additional advantages of computer-type control.

By E. H. PRESTON, Field Engineer, Market Development Division, Leeds & Northrup Company

THE MODERN electric power dispatching facility today is equipped with a number of tools to aid the system operator on his job: system diagram boards with symbols and lights indicating system configuration; automatic slide projectors with substation switching diagrams, telemetered watts, vars, volts, and other system quantitative information displayed and trended on recording instruments; incremental loading slide rules; average and incremental cost data stored in typewritten or electrical equivalent form; automatic control of remote switching functions; and area generation control for meeting interconnection and system generation requirements. The immediate job ahead appears to be one of refining information collection and computing techniques, and automating those functions which are repetitive and which can economically aid operating decisions.

Progress in the power dispatchers' operating tools is exemplified by the installation of Desired Generation Computers on a number of power systems. These currently are a-c analog computers whose inputs are dynamic (telemetered) system data or handset constants. The outputs of these computers are used for operating guides, or directly for automatic control. Computational output accuracies are better than 0.5 percent of scale. Fast "on line" computation, ease of operation, reliability, moderate cost input and output devices, and relatively fast return on investment are the advantages of the analog computer solution to the dispatching equipment problem.

Purpose

All of these computers are located in the central dispatching offices where most power dispatching decisions are made. They serve one or more of the following functions:

1. Determine system incremental cost of power delivered to the load.
2. Determine desired mw generation of each generating source for minimum cost of power delivered to the load.
3. Determine percent of power delivered to the load from any source.
4. Determine cost of purchase or sale power at the tie point.
5. Determine incremental bus cost and/or incremental heat rate of any generating source.
6. Determine hydro generating source megawatt allocation on the basis of replacement steam cost and percent of participation with steam generation in system load changes.
7. Automatically control generating sources for minimum cost of delivered power.

Justification for Installation

This computer is designed for the use of power dispatching personnel in reducing the fuel and power purchase costs in getting energy to the revenue meter. Some of the specific sources of savings are:

1. Accurate incremental loading.
2. Inclusion of transmission losses in studies of system loading and "Wheeling" through power.
3. More accurate pricing of economy interchange. (A system operator on the phone with a neighboring utility and about to decide on interchanging economy power, can make profits or losses amounting to many dollars annually.)
4. Reduction of manual calculation time for economy loading.
5. Better decisions on fuel and generator loading alternatives.
6. Up-to-the-minute results in studying ever-changing system conditions which involve operator decisions, such as use of hydro or alternate sources of energy.
7. Higher utilization of this computer — available for dynamic operation in the system control — instantly separable for study work 24 hours a day.
8. Smoother system operation and better plant coordination.
9. Release of operating personnel from routine regulating problems to obtain better system supervision.

There are other intangibles related to improved dispatching efficiency, system reliability, and smoothness of operation on which it is difficult to place dollar signs. The value of both tangible and intangible savings must be judged by each utility. An example of tangible savings from a recent study is shown on Fig. 2. Departures from correct economic dispatch significantly increase annual fuel costs, quickly justifying a computer control solution. Any system, planning installation of control, should also consider the many additional advantages of the computer-type control.

Computer Inputs

Input data is either telemetered from the system or set in by hand. The following quantities are the input variables.

1. Type of fuel—oil, gas or coal.
2. Cost of incremental fuel in cents per million btu.
3. Unit performance, or efficiency multiplier, calibrated 90 percent-110 percent.
4. Unit generation constraints —

high and low limits in megawatts.

5. Telemetered tie line and generating source power in megawatts.

When a unit is on multiple fuel firing, whichever fuel (s) varies with generation is selected as the incremental fuel for computation.

Stored Data

Stored data consists of the incremental heat rate curve for each unit and transmission loss constants. The incremental heat rate data is based on boiler-turbine performance tests. The transmission loss constants are adjusted from system board studies.

Normally, the incremental heat rate is set into a unit function generator as an intercept and three straight line slopes. The intercept, inflection points, and slopes are the screw driver adjustments on the front panel of the plug-in, transistorized function generator shown in Fig. 3. Note the test points for checking the input and slope circuits. When the shape of the curve changes for a different fuel, an alternate curve is automatically selected by the operator. The performance dial on the front of the function generator is a 0.9 to 1.1 multiplier on the basic curve. At present, the unit performance setting is based on data from the Results or Production Engineering Department.

The transmission loss constants used in this computer are adjustable resistance equivalents for the constant parameters of the coordination equations determined by a board study. The plug-in potentiometers for these loss constants are arranged electrically in a matrix form with net generation and tie line power of each source as inputs. Net generation can be derived from gross generation input data by mathematical approximations, such as a straight percentage or a subtractive constant and a percentage.

Computer Outputs

Most of the computer outputs are megawatt operating guides. This fact is one of the many reasons for the successful application of these computers as a dispatching tool.

All of the computer output information is selected by pushbut-

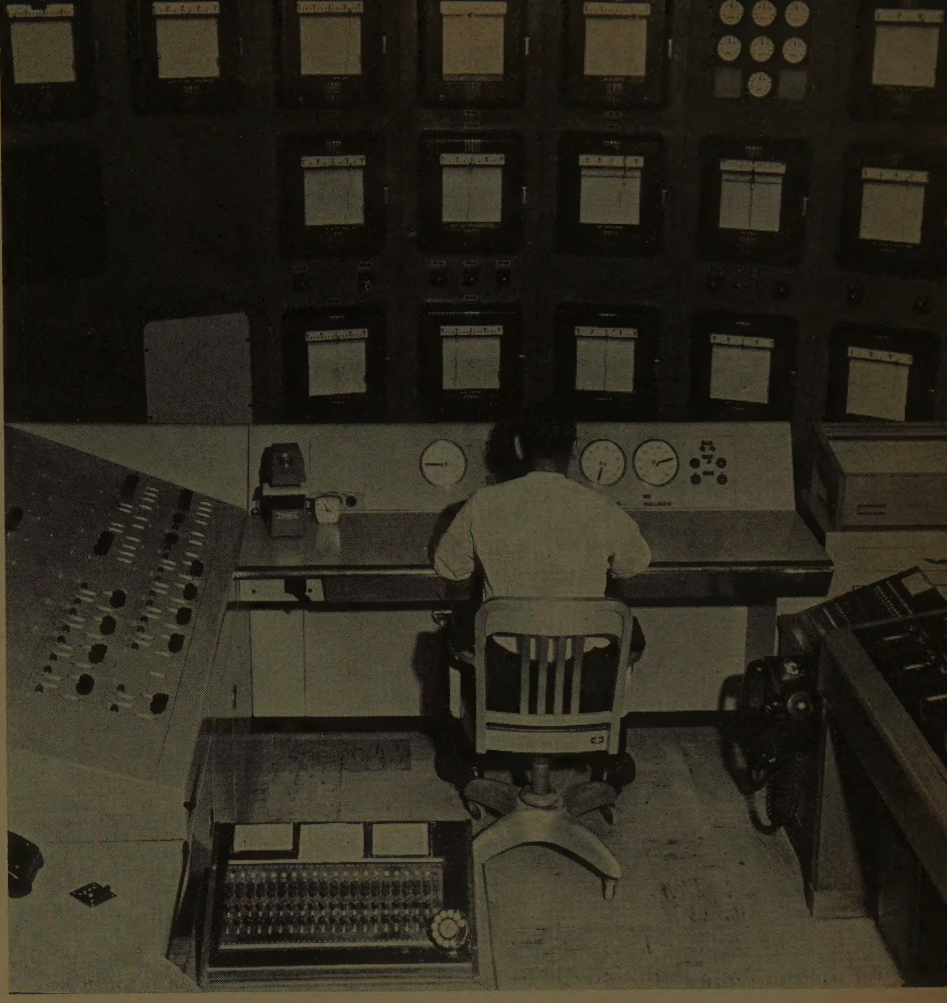
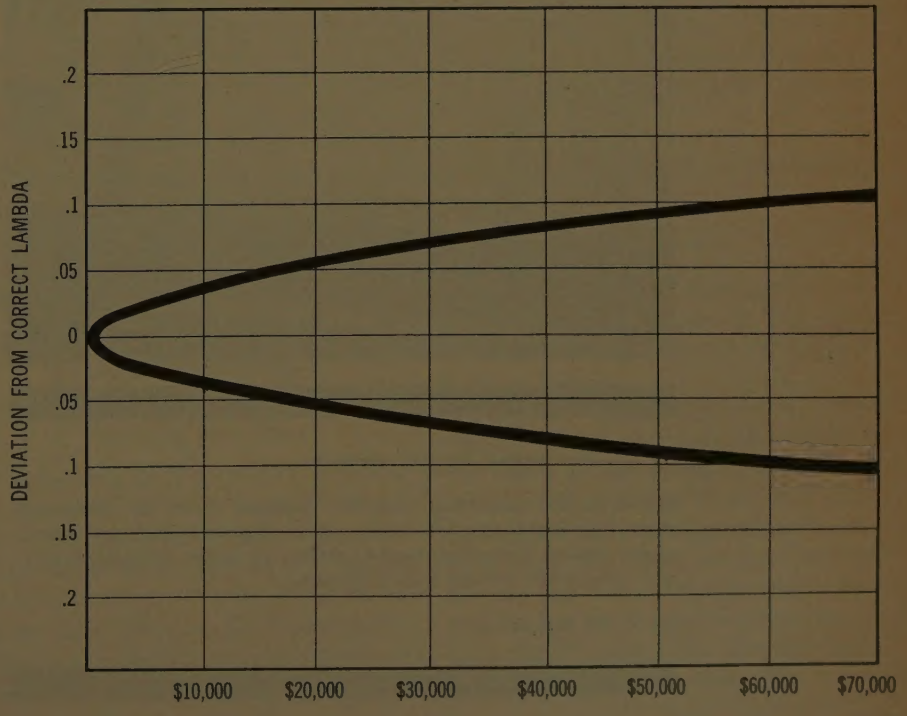
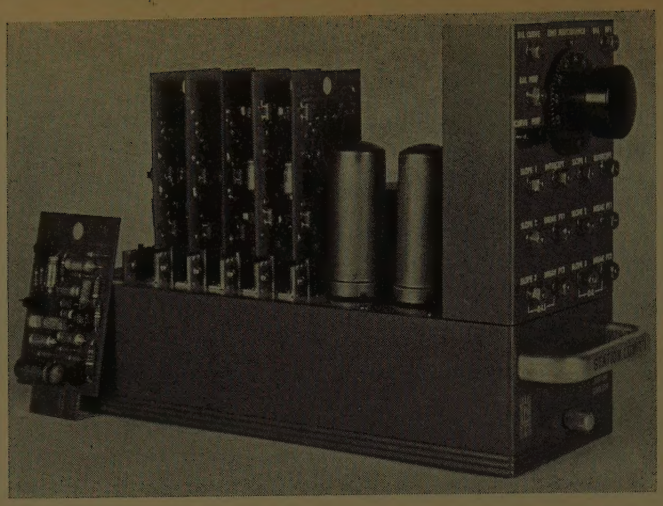
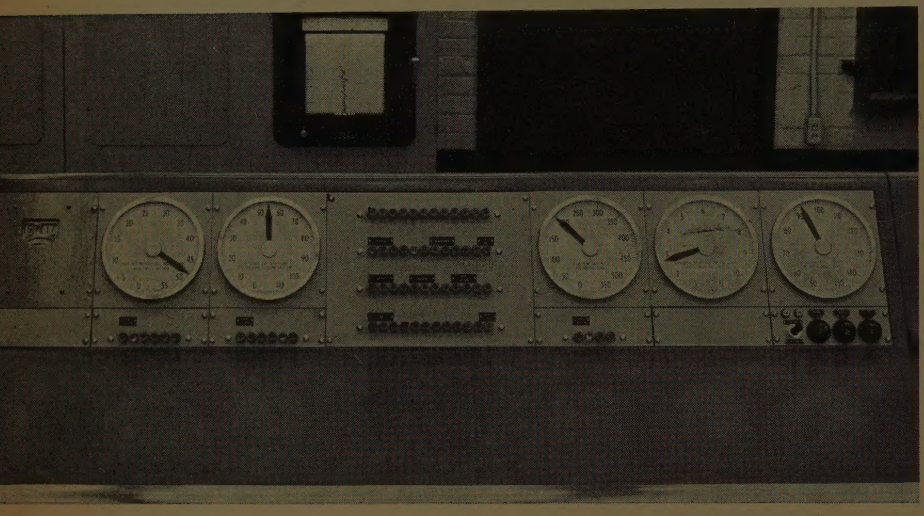


Fig. 1—Desired generation computer in central dispatching office of Eastern utility.

Fig. 2—Precise computer-control holds output of each unit at the ideal system mills/kwh level for lowest overall fuel costs; curve shows how rapidly annual costs climb on a typical 1000-mw system (operating at 65 percent of capacity on 20-cent per Btu fuel) when units are off target.







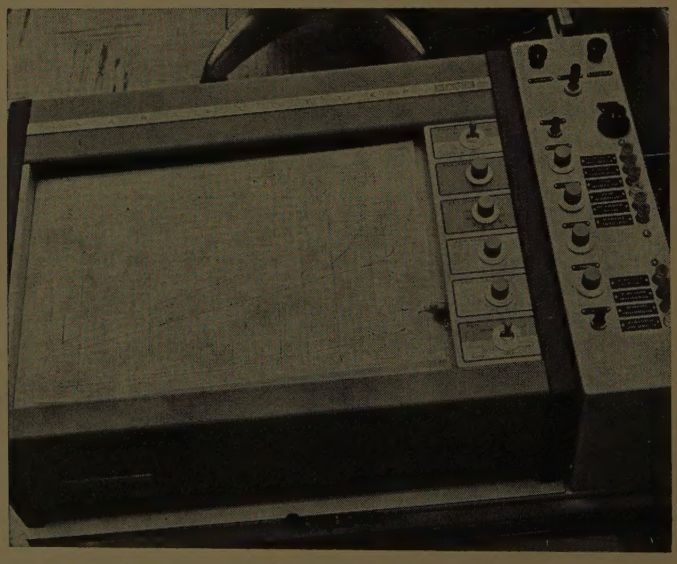


Fig. 3—Transistorized function generator.

Fig. 4—Desired generation computer readouts; from left, indicators show unit incremental heat rate, unit or station desired generation, system desired generation, Lambda station or tie-line incremental cost, and incremental percent power delivered.

Fig. 5—An X-Y plotter.

tons and can be displayed for the operator on:

1. Console indicators as shown in Fig. 4.
2. An X-Y plotter as shown in Fig. 5.

These outputs are also used directly for automatic generation control.

The output of the transmission loss matrix is incremental percent of power delivered. Where a transmission loss matrix is not a part of the initial installation, a handset penalty factor, or percent of power delivered setter is used. Since provision is made for a matrix, it can be added to the computer when required.

Forecasting Operation

In addition to automatic control the computer can be used for studying other than immediate conditions by merely throwing a switch and setting up the inputs for the conditions to be studied. While using the computer for forecasting, it is necessary to guide the area generation control equipment by either schedule setters or high and low regulating limits.

Typical study operations performed with the computer in conjunction with its X-Y plotter are:

1. Compute the economic dispatch for various combinations of generators on the line.
2. Compute the price of economy interchange for varying system loads and tie line flows in advance of an anticipated purchase or sale of power.
3. Determine effect on plant generation of a change in type or cost of fuel.
4. Determine effect of maintenance outage on operating costs for different combinations of units in service.
5. Determine economic use of hydro in coordination with steam generation.
6. Check prior system performance against computed economic distribution of load.
7. Check overall calibration of the computer.

Two examples of computer studies demonstrate significant opportunities to realize potential savings.

When negotiating the price of economy power interchange, the dispatcher can run a series of X-Y

lots of incremental tie line cost in ills/kwh vs system load in mega-vatts. If the tie line flows are pre-ictable, it may be necessary only o use several values of tie line ow at the predicted system load nd read the incremental cost indi-ator. However, in a system with hrough power flow and radial ties, t may be desirable to run a family f curves representing different tie ine flows. A typical X-Y plot for arious power flows is shown in ig. 6. Less than 10 minutes is re-uired to run this data, including et-up time. The dispatcher has a graphic picture of the cost of power t the tie point. Note particularly ow its cost increases over two ills/kwh at high system loads and hat selling increasing amounts of ower at these high loads is ex-remely more critical than buying ncreasing amounts. The value of his up-to-the minute information, ased on actual system operating onditions as compared to precal-culated historical tabulations, lies n reducing costly mistakes in econ-my interchange agreements and n determining the effect of through r "wheeling" power flows.

Another operating aid with a large cost reduction potential is the use of the X-Y plotter to determine the cost per hour for carrying any value of system generation with different combinations of units in service when one of a system's more efficient units is out of service. The value of overtime maintenance dur-ing the outage can also be con-sidered. To determine the total cost of carrying any value of system generation, curves of system in-cremental cost for each combina-tion of units is plotted against total generation as shown in Fig. 7. The area under each curve from a mini-mum to maximum anticipated gen-eration is the cost in dollars per hour above that minimum. To this cost can be added the known cost per hour of generating minimum load on all the units represented by the curve. The result is total cost in dollars per hour. Since the differ-ence in cost is of interest in most cases, the area between the curves plus the difference in generating minimum load is used in each case. The difference in total cost per hour for values less than the maximum total generation is found by sub-tracting the area between the curves omitted, as the total generation level is reduced. By reviewing the expected load curve for the day in question, it is possible to estimate the cost per day for operating dif-ferent groups of units. The time in-volved in this study is primarily in planimetry of the area between the curves and in adding the difference in cost per hour for each hour of the day. Some alternatives can be quickly eliminated by visual com-parison of the system incremental cost curves. The major advantage of this method is the ability to use up-to-the-minute conditions and being able to display them graphi-cally for an operating guide. At present all total cost studies or studies involving load duration curves require some hand calcula-tions after obtaining analog com-puter data. Most of these calcula-tions can be done in a very few minutes on an adding machine. While results are being studied, the computer is returned to auto-matic control.

Computer Operation

To understand the operation of the Desired Generation Computer, recall the principle for minimum fuel consumption: generating units on the same bus and firing the same fuel should be loaded to the same incremental heat rate, or the change in btu/kwh input per unit step in generation should be the same for all units. Where turbine generators are operating with different fuels, it is necessary to add a fuel cost multiplier in cents per million btu for each fuel in the station so that incremental cost is the basis of comparison. Then, the common in-put is incremental cost and the heat rate input to each function gener-ator is obtained by dividing the incremental cost by each unit's or station's fuel cost in accordance with the expression:

$$\text{Incremental heat rate} = \frac{\text{inc. cost } (\phi/\text{kwh})}{\text{fuel cost } (\phi/\text{mbtu})}$$

Referring to Fig. 8, the input of incremental cost is applied to all function generators. This electrical equivalent of ϕ/kwh of the incre-mental cost curve is the same for all units. The function generator's out-put is the electrical equivalent of the desired MW generation of the incremental cost curve. The result-ing outputs of each function gen-erator for the same cost input rep-resent the optimum loading. To these ideal curves are applied the restrictions of high and low regu-lating limits, and the performance multiplier mentioned earlier.

The open loop circuit shown in Fig. 8 can be made automatic and positively positioned by having the incremental cost input determined by the difference between a preset total generation and the sum of the unit desired generation outputs, or for automatic control, by the dif-ference between actual total gen-eration plus the system's required mw change and the sum of the unit desired generation outputs. A cor-rect incremental cost is computed when the sum of the desired mw outputs of the function generator matches the actual system genera-tion plus the system requirement. The closed loop equation for this is:

$$\Sigma P \text{ actual} + \Sigma \Delta P - \Sigma P \text{ desired} = 0$$

Such a system can be used for incrementally loading all turbine-generators on one bus, and is often used in station sub-loop automatic controls. The addition of a multi-plier on the bus costs at each plant to include the incremental trans-mission losses is used to load gen-erators on different busses. The formula to be solved by the analog computing circuits in this case is:

UNIT GENERATION:

$$P_1 = f_1 \left[\lambda \left(1 - \frac{\partial P_L}{\partial P_1}\right)\left(\frac{1}{F_1}\right)\right]$$

where P_1 = unit generation in mw.

λ = system incremental cost in ϕ/kwh

$1 - \frac{\partial P_L}{\partial P_1}$ = percent of power de-livered

F_1 = fuel cost in ϕ/mbtu

The function f_1 relating the two sides of the equation is the unit incremental heat rate curve: mbtu/-kwh vs. mw.

To place the computer on auto-matic control the operator selects the units to be placed on control, selects the correct fuel, and sets the high and low regulating limits. Operating the reset control switch causes the area requirement con-trol to be routed automatically in accordance with the desired mw output of the computer. The com-

puter is then operating in a closed loop. The system incremental cost, lambda, is continuously computed so that the total desired system generation is equal to the actual telemetered generation plus the area required generation change (new load increase or decrease). The effect of this closed loop operation is that a destination for each generating source is assigned for each system load change. Each generating source is compared against its new megawatt destination in order to determine its increase or decrease requirement. This feedback of actual generation assures that each generating source does its job of economic regulation.

Published statements from one installation indicate actual kwh for the periods checked is within 0.5 percent of the computed kwh for the units. Other installations are normally holding to the computed schedule well within one mw on each generator.

Where the available mw/min. of economic regulation is not sufficient to handle sudden extreme load changes, the control system temporarily bypasses the economic assignment. Generation of all units is automatically controlled in a direction to correct the area requirement within the respective high and low regulating limits of each unit. For example, on a recent installation in Wisconsin, lightning tripped out over 30 mw of paper mill load. The four units on control corrected the disturbance within two minutes. Had the units responded only on their incremental curves, the older units would have had most of the regulating burden, with a consequent longer time to restore the system to a balanced condition. No manual generation changes were involved with this correction, leaving the operator free to handle the switching for restoration of service. By providing positive limits on the rate of change of each unit to match the response capability of the steam pressure control, boiler upsets were prevented. All units automatically returned to their economic schedule shortly thereafter.

Another feature of the closed loop operation of the computer is the independence of one generator's response from the response of other units. Because the computer balances system lambda for total desired generation, the generation assignment for each unit is fixed for any system total generation. If a unit is not properly loaded, it will be corrected to its economic assignment instead of swinging other machines to compensate. This independence of control response eliminates any interaction or hunting between units caused by differences in governor characteristics and boiler response.

It can be shown also that the computer-control functions correctly for interconnected system operation regardless of whether the load change is in the computer's control area or in a neighboring area. For instance, on a remote area upset, the computer calculates the economic allocation of system frequency bias contribution. The computer executes economic generation changes always in a direction to satisfy the frequency bias obligation. The generator governors are permitted to supply the frequency stabilizing energy and any deficiency in their response to the frequency change will be supplemented by the automatic control according to economic dispatch and the tie line bias commitments. The computer-control is also interlocked with suspending and tripping features for failures, such as signal loss of telemetered data, excessive frequency deviations, loss of supply voltage, as well as control-blocking high and low limits.

The new Desired Generator Computer-Controls have usually gone into operation in one to three weeks after installation and interconnecting wiring. Since the control does essentially what an operator attempts to do manually, with the computer-control quantities being in megawatts, operators quickly understand its use. In fact, it is usually difficult to remove the control from service once it has been accepted.

It is all too easy to shortchange operating personnel on training sessions. The tendency at first is to leave the computer "on control" as this relieves operating personnel of the regulating and generation dispatching burden. However, specia training sessions assure better us of the equipment.

Since most of the computer inpu and output information is already appreciated by operators, it is mere ly necessary for them to becom familiar with this new method o obtaining these operating guides Using pushbuttons to read out vari ous quantities, setting up the X-Y plotter by pushbutton and rang dials, switching generating units i and out, and changing inputs suc as fuel costs are all easily under stood operations. Obtaining cos information becomes routine whe the procedure has been set up—an the results obtained are invaluabl in reducing system operating cost

The use of solid-state circuitr has resulted in well over 99 percen reliability of these computers eve in the first year. Three installation have reported between 99.3 per cent and 99.8 percent reliability These installations have been i service for at least one year. Mai tenance of the computer circuitr is simplified by the use of test jack for each operation performed b the computer. The use of simpl adding, subtracting, and dividin circuits in the computer makes easy for maintenance personnel t understand the function of all ci cuits. Plug-in transistor cards, an other components reduce outag time. Progressive design, for exam ple, the use of only two standar types of transistor amplifier card for the entire computer, minimize the need for spare parts.

Types of service personnel var depending on the utility. Eithe Relay Department, Communica tions Department, or Station In strument Maintenance personne are assigned to this equipmen Only a moderate amount of add tional instruction is required fo the service personnel to be trained

Summary

Development and refinement economic dispatch computer-co trollers has been rapid in the la few years. The following major a vances have taken place in thes devices.

1. Automatic computation

megawatt unit and station generation schedules has become part of the device.

2. Computation of incremental transmission losses has gone from hand calculation to an integral part of the computer.
3. Variable input information has become dynamic and instantaneous.
4. Handset inputs are digitally-displayed and are calibrated in terms readily understood by dispatching personnel.
5. Output information is displayed on 0.3 percent indicators, and on X vs Y or X vs time coordinate plotters.
6. Computer outputs are used directly in automatic generation control.
7. Accuracies of computation are normally within one mw of that obtainable with digital computation techniques.
8. Transistorized equipment has reduced space, maintenance, and heat dissipation.
9. Plug-in components and design for ease of maintenance have minimized outages.

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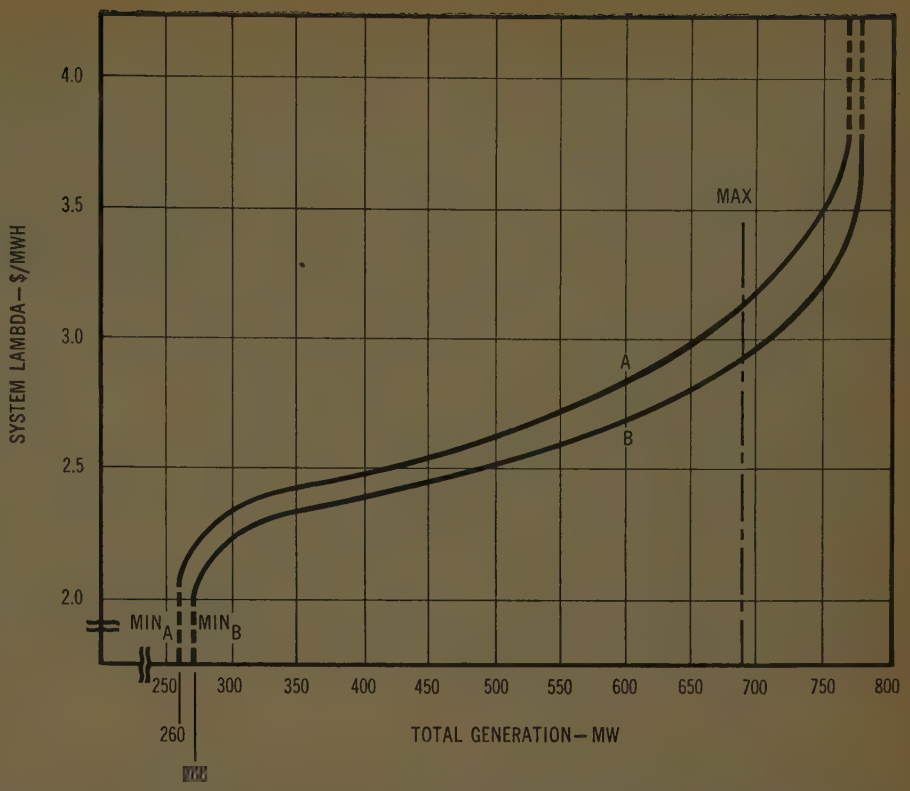


Fig. 6—Typical X-Y plot for various power flows, showing tie-line incremental cost vs. system load.

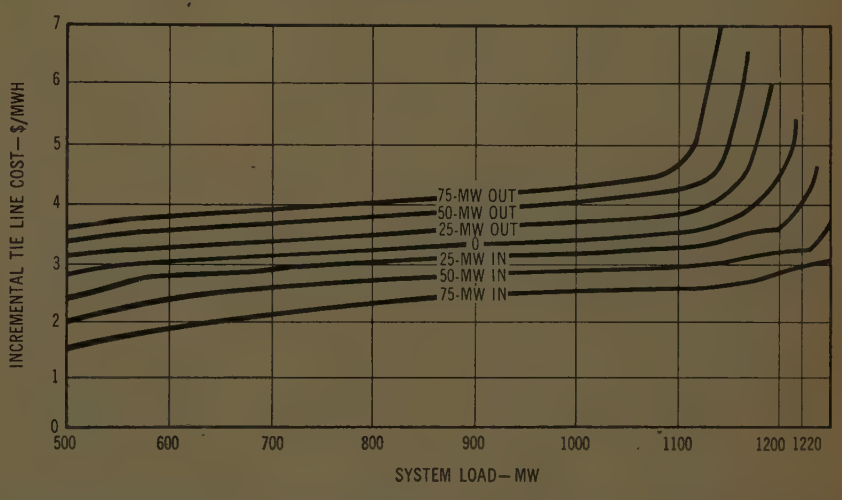


Fig. 7—System incremental cost for each combination of units is plotted against total generation to determine total cost of carrying any value of system generation.

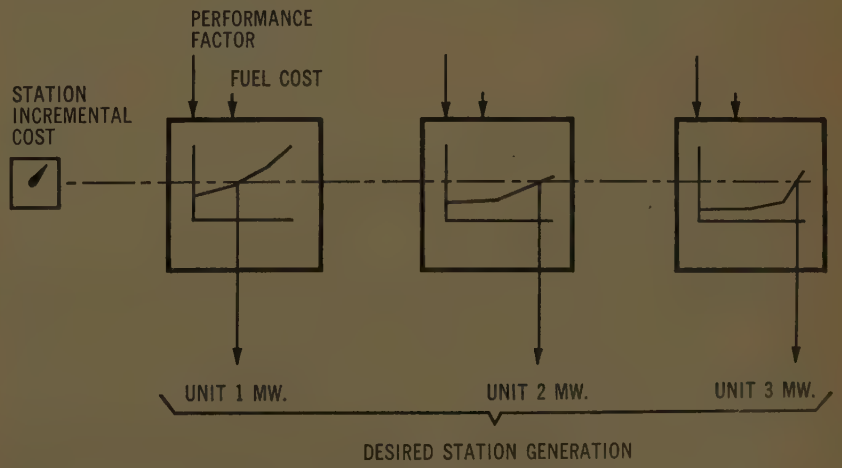


Fig. 8—Open loop desired generation computation.

CUSTOMER TRAINING COURSES AID SALES PROGRAM

Industrial customer training courses by Baltimore utility prove useful service. In first 12 months after first course, "students" installed 933 kw of lighting.

By EDWARD M. KANE, Engineering Representative, Industrial Power Dept., Baltimore Gas & Electric Co.

ELECTRIC POWER can only be valued and appreciated by industrial customers if they are aware of and able to enjoy to the fullest the benefits which it can provide. While the time-honored method of using personal calls by highly-trained industrial power representatives continues to form the backbone of our industrial sales program, we have found that these individual efforts can be greatly augmented by a sound program of formal customer training.

Since early 1959, the Industrial Power Department of the Baltimore Gas & Electric Company has conducted five courses for some 259 men representing 121 of our large industrial accounts. The five courses actually covered three subjects: industrial lighting, process heating and in-plant power distribution, with the lighting course being presented three times.

Latest Developments

Each of the courses is aimed primarily at familiarizing the students with the latest developments in a particular field of power application. This is accomplished through lectures, demonstrations, and field trips. In addition, a sizeable amount of class time is spent working typical problems to demonstrate the practical application of the theory that is taught. We do not believe, however, that these courses will make the students experts in the particular subject, but feel that they are successful if they impart to the student sufficient knowledge upon which he can decide whether or not he has use for a particular application. You might say the courses are in the same realm as music appreciation courses; the student learns to determine what is good and what is bad but never learns how to play the horn.

Certificates Awarded

At the conclusion of each course, those who fulfilled the attendance and homework requirements were awarded, through their superiors, certificates of achievement. We found that this method not only helped the individual in his own firm but also served to point out to our customers' management the steps we are taking to assist them.

Our experience over the past two and one-half years has merely strengthened our belief that the use of customer training courses is a fitting way in which to promote electric power. The courses call to the attention of the students entire areas of power applications to which they have possibly given very little thought. You might say that they achieve the first requirement of good selling; they create the need. Secondly, they are good customer relations tools in that they are tangible proof that our Company is interested in seeing that the customer is using our electric service to his greatest advantage. Third, they create in the customer's mind the feeling that the power company has available the experts to help him with his problems, thus creating a more receptive atmosphere for our power representatives.

Advice To Others

To those who have yet to embark on a course of formal customer training, perhaps a few words of advice will be welcome. First, we have found that it doesn't pay to rush into a program too quickly. While the courses as received are rather complete, it is important that the instructors have sufficient time to become thoroughly familiar with the course and make any changes necessary to conform to local conditions. Second, we believe the invitation list should be drawn up with care. Strive to have the classes made up of men of as nearly equal ability and responsibility as possible. If the spread of ability and responsibility within the class is too wide you will lose the best of the class to boredom and the worst of the class to confusion. We have found that by specifically inviting supervisory personnel, the spread of talent can be minimized. Third, once a schedule has been established, stick to it. There is nothing that the students despise more than having the classes run longer than originally scheduled. Fourth, try to keep your sales allies informed of what you are

"Students" from 51 industrial firms in Baltimore area are seated at tables to facilitate working class problems. This group is taking the "Electric Power Distribution for Industrial Plants" course. After first lighting course, students installed 933 kw in lighting.

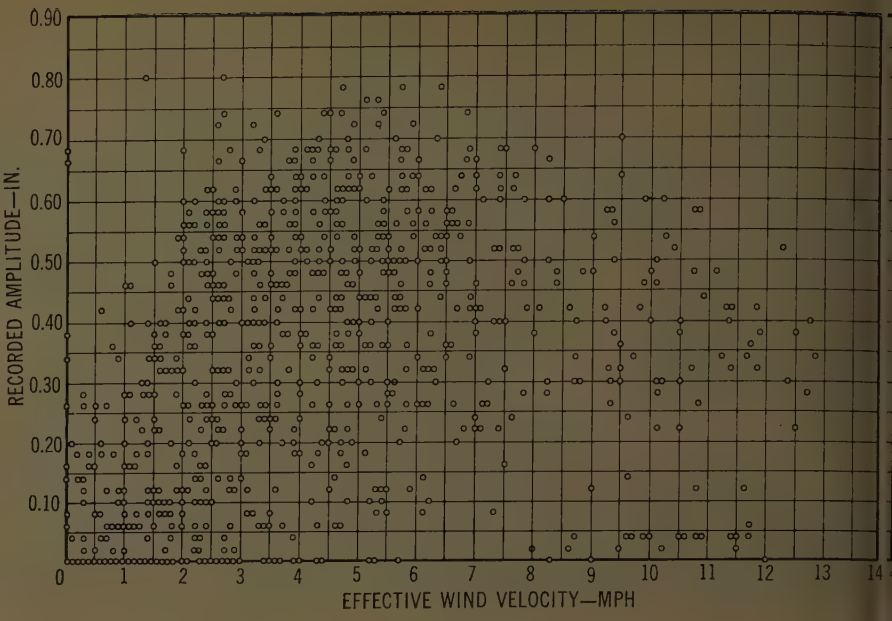
Demonstrating various sources of infra-red heat for a class of customer personnel taking the "Metal Sheath Heater" course is Ralph C. Young, senior engineering representative, Baltimore Gas & Electric Co.

doing. They not only appreciate knowing what is happening, but they also are quite helpful in supplying demonstration equipment. Finally, keep the courses as noncommercial as possible. No one appreciates being trapped into hearing a two-hour sales pitch. The courses are so designed that the subject matter is capable of selling itself if presented in an interesting manner.

As far as results are concerned, we have only attempted to measure them for our first course, which was the "Fundamentals of Industrial Lighting" offered in the spring of 1959. A survey of the men who took the course revealed that they had been instrumental in the installation of 933 kw of lighting in the first 12 months after they completed the course. In addition, the comments received from the management of the companies who have participated in the course lead us to believe we have performed and are performing a useful service for our customers.

We expect to continue our program for some time to come, and firmly believe that our efforts are not only an effective aid towards the achievement of our goals, but also are in the highest tradition of power sales in that the courses fulfill a useful service for our customers.

Fig. 1—Maximum vibration amplitude recorded on test line without armor rods was 0.8 in.



Vibration, by-product of longer spans and higher tensions, can be reduced by application of armor rods or dampers, depending upon energy dissipation required; rods contribute no further damping when dampers are used.

CONDUCTOR VIBRATION DAMPING

By ROBERT E. LARSON, Rome Cable Division, Aluminum Company of America

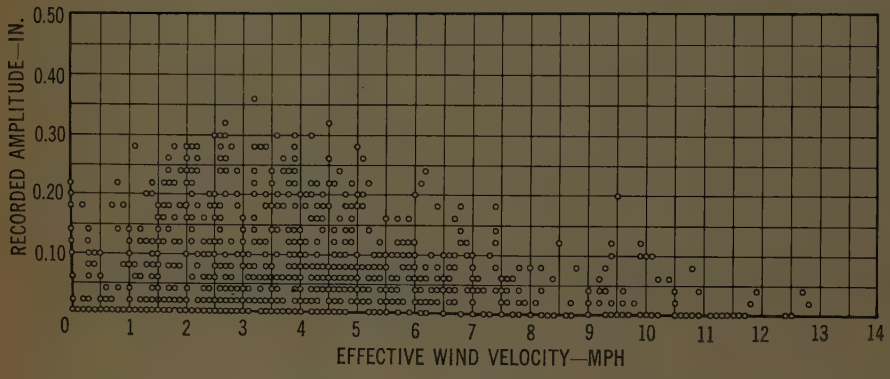
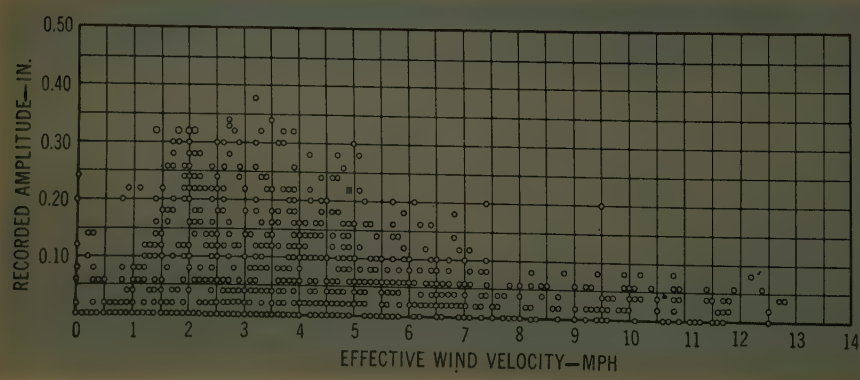


Fig. 2—(above) Maximum amplitude with wrench-applied, tapered armor rods was 0.36 in., and with straight rods, Fig. 3 (below), 0.38 in.



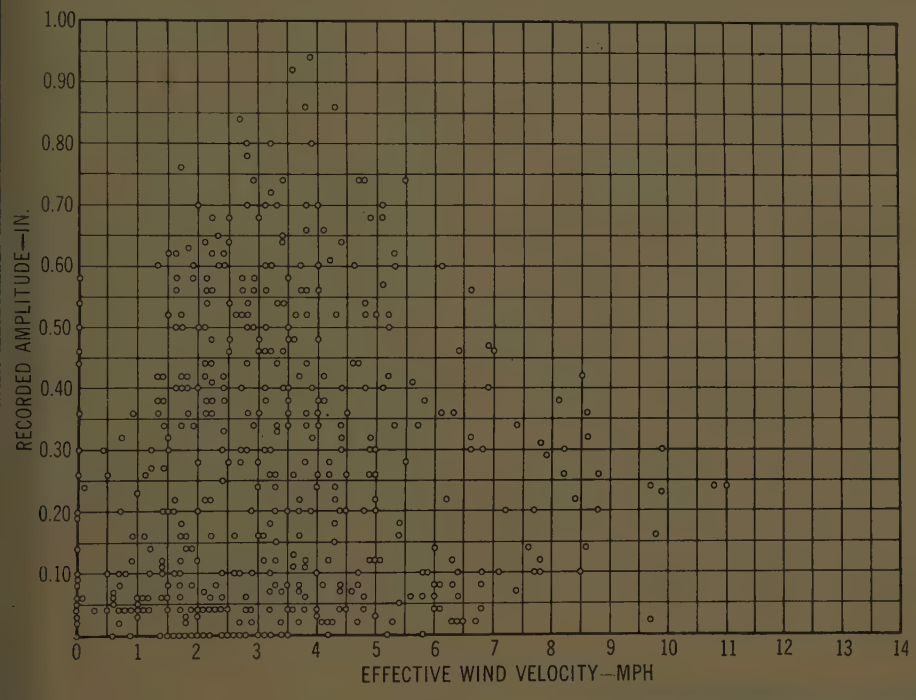
THE TRENDS toward use of larger conductors, longer spans, higher nominal tensions, more flexible conductor supports, and lighter and more flexible towers make it essential to consider more carefully the probability and hazards of vibration and the means of preventing damaging vibration. This pertains not only to the possibility of conductor damage but also to damage which might result from transmission of vibration from conductor through suspension assemblies to insulator strings and to towers.

Tendency of a conductor to vibrate increases rapidly as conductor tension is increased. Conversely, self-damping increases as tension is reduced; conductor vibration is almost never observed at stringing tensions less than about 10 to 12 percent of ultimate strength. One way to protect transmission lines, therefore, is to reduce conductor

Editor's Note:—This is an adaptation of a paper presented by the author at the 1961 Conference of The Engineering and Operation Section, Southeastern Electric Exchange.

tensions to a point where vibration will not be destructive.

Studies made by Alcoa 30 years ago for the purpose of avoiding damaging effects of aeolian vibrations led to limitations of 25 percent final and 33 percent initial conductor tensions with no ice or wind at designated loading temperature. If self-damping characteristics are inadequate within these limits, additional damping should be obtained by using available damping devices. A number of inhibiting and protective devices have been developed for dissipation of vibration energy, the most commonly used being armor rods and Stockbridge dampers. While the former provide reinforcement and protection from mechanical damage at support points, their principal effect is vibration damping.



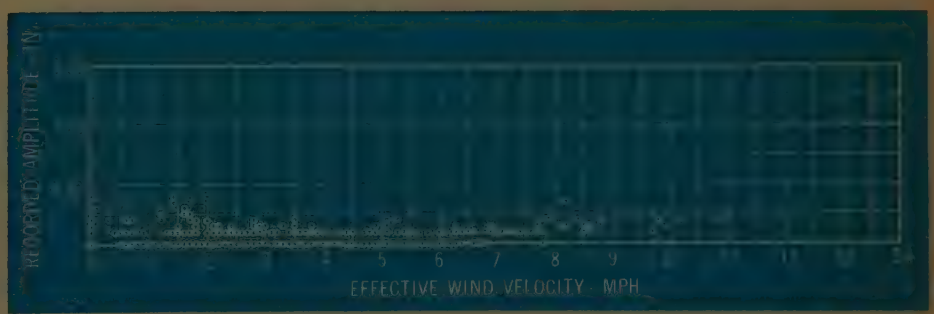


Fig. 4—(above) Undamped span had 0.94-in. maximum amplitude while span with Stockbridge damper at one end only, Fig. 5 (right), scored 0.08 in.

Effect of Armor Rods

A comparison of Figs. 1, 2, and 3 shows effectiveness of tapered (Fig. 2) and straight (Fig. 3) wrench-formed armor rods in inhibiting vibration amplitude. These charts represent data acquired in testing three parallel spans at the same time by the same methods and are typical of recordings made over many years with various conductors. With no armor rods used (Fig. 1), maximum recorded amplitude was 0.8 in. (Recorded amplitude is not necessarily maximum wave loop amplitude; it is measured at a fixed location and the loop length varies with wind velocity.) With tapered rods wrench-formed at both ends of spans (Fig. 2), maximum amplitude was 0.36 in. With straight rods wrench-formed at both ends of spans (Fig. 3), maximum recorded amplitude was 0.38 in.

Reduction of amplitude with both straight and tapered rods was effective over the entire range of wind velocities. Thus, it may be discerned that for areas where energy dissipation of conductors and effects of wind turbulence are so great that only a small amount of increased damping is required to keep vibration amplitudes within tolerable limits, these wrench-formed rods provide an effective and economical method of protecting spans.

Application of Dampers

Exposure to steady winds or use of high tensions and long spans can require greater energy dissipation than can be achieved by armor rods. An effective and commonly used energy dissipator for such conditions is the Stockbridge damper. This consists of two weights resiliently suspended from the conductor and rigidly attached to the ends of a horizontal steel cable that, in turn, is attached at the midpoint to the conductor.

Because of the relatively high masses of the damper weights, the steel supporting cable is not stiff enough to force these to follow accurately the motions of the cable clamp. This results in flexure of the supporting steel cables. The flexure causes slipping between its strands and consequent dissipation of energy by inter-strand friction. Vibration of the span is suppressed to negligible and harmless proportions when the damper and conductor span can dissipate energy at a rate greater than the rate at which the wind can impart it.

Effectiveness of these dampers is shown by comparing Figs. 4 and 5. These represent graphic results of simultaneous tests on two parallel 1000-ft spans of 397,500 cm ACSR 30/7 over a period of about a month. Both spans were supported by the same pair of structures and tensions were 25 percent of ultimate strength at 60F. Significant amplitudes were recorded for wind velocities as high as 11 mph.

Highest amplitude recorded in the undamped span, Fig. 4, was 0.94 in. Highest amplitude recorded in the span having a damper at one end (Fig 5), the end opposite the

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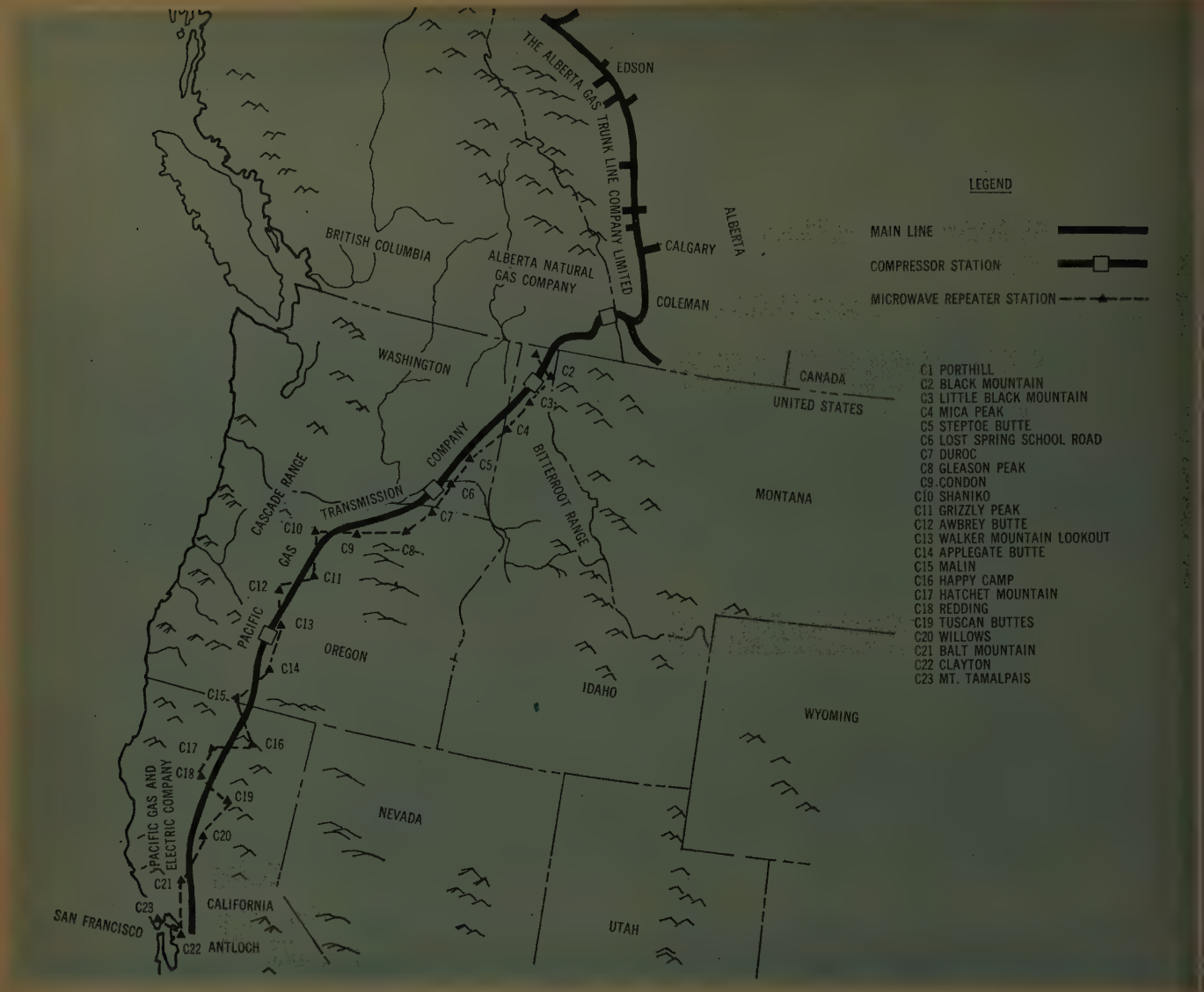

Fig. 1—This map indicates the route of the Alberta-California pipeline and microwave systems. The dotted lines are backbone hops and the triangles are repeater stations. That portion of the pipeline facilities serviced by the new microwave system extends from the Canadian border to San Francisco. The facilities in Canada will have leased services.

TELLUROMETER SURVEY MAPS 1100-MILE MICROWAVE SYSTEM

Utilization of Tellurometer method to establish an 1100-mile microwave system for natural-gas pipeline produced accurate survey data in a short time and at low cost.

By H. E. RAGSDALE, Supervising Engineer, Pipeline Division, Bechtel Corporation, San Francisco, Cal.

THE MAJOR PROBLEM in developing design for a microwave system, especially in sparsely-populated mountain regions, is obtaining accurate information on the location and elevation of all possible station sites. Also, possible microwave obstructions must be located. For the Alberta-California natural-gas pipeline system the problem was made more difficult by the fact that for some areas only 1:200,000-scale U.S.C.&G.S. quads or county maps were available.

A new method was selected to survey the microwave paths, based on the Tellurometer. This highly-sensitive measuring instrument, actually a miniature microwave station operating on the radar principle, is highly accurate over long distances and greatly simplifies surveying across rough country.

Not only did the Tellurometer method produce very accurate survey results, but it did so in half the time and for about a third of the cost that would have been required for the next best survey method. Furthermore, its use may have provided a practical design check of the communications performance to be expected over the entire microwave system.

Operation of every large-diameter pipeline urgently depends on an ef-

ficient communication system. For many such pipelines, microwave communications prove best. And it was this kind of system that was recently decided upon for the gigantic Alberta-to-California natural-gas pipeline.

Each day it operates, this enormous transmission system, using pipe 36 inches in diameter, will be delivering several hundred million cubic feet of Canadian gas into Pacific Gas and Electric mains near the San Francisco Bay Area. Bechtel Corporation was appointed engineering-manager for this project from the point of origin in Alberta to the California border and part of the job was the design of a communications system. The microwave communications system that Bechtel recommended to P.G.&E. starts at the Canadian border and stretches in a general southwesterly direction 1100 miles through Idaho, Washington, Oregon, and California.

A New Survey Tool

The Tellurometer instrument survey method makes use of radar combined with an amazingly precise device for timing the radio wave echo. The basic components of a Tellurometer are a miniature microwave station, an oscilloscope to read transmission time, a directional dish antenna, and audio communications. The instrument originally developed operates on 3000 megacycles and is effective over distances of 40 to 50 miles. A newer version, called the Electrotape, operates on 9000 megacycles and is said to be accurate within two feet over distances of as much as 110 miles. Such precision is possible because the echo can be timed to the nearest tenth of a billionth of a second.

Although this was one of the first commercial applications of the Tellurometer survey method, it promised fast and accurate survey data which could be used by manufacturers of microwave equipment to design units to fit the Alberta-California system. In addition the 9000-megacycle Electrotape units could provide a path check for the permanent communication system itself.

The basic problems of the survey crews were:

(1) to make an 1100-mile traverse from the Canadian border to Antioch, California.

(2) to determine the exact location of the 19 repeater sites along the backbone system and the distance between those sites.

(3) to determine the location and distance of some 20 spur hops to facilities along the pipeline.

(4) to determine the exact location and elevation of possible microwave path obstructions—whether local or distant—within specified Fresnel zone tolerances.

Besides the Tellurometer instruments themselves, barometers, psychrometers, and Askania Theodolites were used to make the survey.

Reconnoitered Each Site

Even before the field survey began, a team of P.G.&E. and Bechtel engineers completed office surveys of the backbone microwave hops, making use of all available quad sheets and aero maps. A team was also assigned to reconnoiter the pipeline-system route, including a visual inspection of each communication site. Even after this work was done, however, there still remained the task of obtaining an accurate survey to verify the existence of reliable communications paths from point to point, to measure the precise differences between antenna locations, and to determine the exact geographic location and elevation of each communication site.

The hops on the Alberta-to-California microwave system range from 30 to 70 miles. To measure the slope distance between any two sites making up a hop the survey teams first set up the Tellurometer and established radio communication. Telemetric pressure and temperature measurements were then taken and the index of refraction determined. The last step was to read the transmission-time interval indicated with such fantastic precision by the Electrotape outputs. Knowing the elevations and atmospheric conditions, the elapsed time could then be directly converted into a miles-and-feet measurement of the slope distance.

To determine the exact horizontal distance between sites, the survey crews used an Askania Theodolite in conjunction with the Electrotape machine. This type of Theodolite is a high-precision instrument which measures vertical angles direct to a second of arc. With this kind of accuracy available, the closures on this portion of the work were held to an average of one part in 30,000.

Path Obstructions Big Problem

One of the major problems for the surveyors was to measure the height and distance of possible obstructions in the microwave paths. In most cases these obstructions were mountain peaks in very rugged country. To make a ground survey

Fig. 2—Instruments set up for a survey. The Askania Theodolite (left) measures the vertical arc and the Electroplate measures the slope distance.

would have required several days to pack in and out of each location.

A two-step approach was used to cut down crew time and effort. First, strips of aerial photos covering the entire backbone microwave system were obtained from the U.S.C.&G.S. Site-to-site microwave paths were traced on these photos, which were then sent to aerial control for spotting of possible mountain obstructions by the use of stereo techniques and a Kelsh plotter. By employing this method only the doubtful obstructions had to be checked in the field.

The second step took care of the field checks by helicopter. Riding this "magic carpet," the crews could quickly locate and occupy questionable obstruction points. Actual survey work was speeded up by also using the helicopter as a set-up site and making observations on it while it hovered above an obstruction.

All survey data were sent daily to aerial control in Los Angeles. There the latitude, longitude, azimuth, and elevations were accurately computed and forwarded to San Francisco, where Bechtel engineers checked the microwave paths on earth-radius profile sheets.

Encountered Some Difficulties

The Tellurometer survey system was not without its problems, but most of them came up because this was a pioneering application. To be sure, the method was used by the Marines during the war for minefield and other military surveys, and more recently by oil companies for making concession surveys in uncharted desert areas. But this was the first time it was used for a large-scale survey of a microwave-communications system.

All the problems that did come up were readily mastered. In most cases they were due to equipment failure, inexperience of the crews in microwave-survey work methods, inadequate communications, and unfavorable weather. As the survey progressed the crews quickly developed their skills. Their efficiency mounted rapidly, and in the later stretches of the survey they were

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Fig. 5—The control panel of an Electrotape.

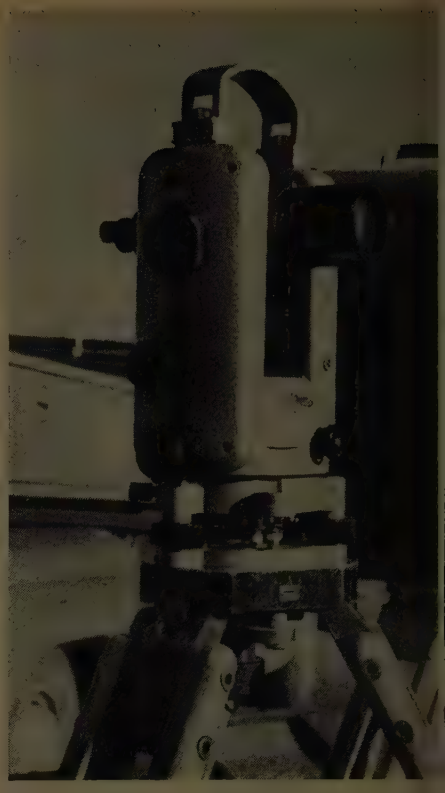


Fig. 6—This type of Askania Theodolite measures vertical angles direct to a tenth of an arc.

Fig. 4—Survey crew taking measurement readings by line of sight.

Fig. 3—Before using the Tellurometer instrument the operator establishes communication with the distant unit by microwave telephone.

Florida Power Corp. selects UNION METAL H-Frames for over-water installation

INSTALLATION DATA

PROJECT: 66-kv line for Florida Power Corporation.

LOCATION: Across Apalachicola Bay.

STRUCTURES: 90-foot galvanized steel Monotube self-supporting H-Frames.

SPACING: 1150 feet.

TOWER DESIGN LOADING: 135 mph hurricane wind conditions, (45 pounds per square foot wind on towers and conductors).

CHIEF TRANSMISSION ENGINEER: C. B. Benham, Florida Power Corp., St. Petersburg, Florida.

If you are not already familiar with the many advantages of Monotube transmission line structure design, an inquiry will bring detailed information.

UNION METAL

Monotube Transmission Line Structures

THE UNION METAL MANUFACTURING COMPANY

Canton 5, Ohio • Brampton, Ontario

Colleges Get Big Lift . . .

Utilities Boost Aid To Higher Education

"One area in which private business can be of tremendous service and strike a blow for free enterprise is in the field of financial aid to private colleges and universities. . ." A college economics professor included this recommendation in his observations following a long look at an investor-owned utility company on a summer fellowship program.

After studying in some detail the operations, structure and relations of Virginia Electric Power Co., Dr. Bruno J. Hartung of Wheeling (W. Va.) College inserted in his report of reactions this appeal: "In order to keep open the doors of private education, we need the support of private industry . . . support not in terms of a few thousand dollars, but support in much larger amounts than are currently being offered by the business community. Failure to receive this form of aid will drive business enterprise institutions inexorably into the arms of the federal government."

This summer, spokesmen for the investor-owned utilities reiterated their recognition of the importance of such aid to higher education. And, a renewed appeal went out to leaders of utility industries throughout the nation in a new folder published by the Independent College Fund of America, Inc.

The brochure records the fact that more than 180 utility companies in 26 states are established contributors, through most of the 40 state and regional associations representing nearly 500 member institutions across the U. S.

Through the IFCA movement, called the largest "community chest" effort for higher education in the nation, more than $50-million has been raised in 13 years of industry solicitation. Among the liberal arts colleges banded together in the state associations (which are coordinated by the IFCA) are some which have been in existence for over two centuries.

Special endorsements of the program for supporting higher education come from top utility executives like Walker L. Cisler, Donald S. Kennedy, Robert H. Gerdes and R. M. Watt.

Says Detroit Edison's Pres. Cisler: "On the experience of the Detroit Edison Co., I can recommend highly the "Association Way" of supporting private higher education. We find it most effective for implementing cooperation between education and industry. We have gained a deeper appreciation of the goals of educators and of their role in a free society . . . and in turn, we feel that through the same channels of communication the colleges have broadened their understanding of American enterprise and business management."

Says Oklahoma Gas & Electric Co.'s Pres. Kennedy: "The joint effort of the independent colleges is a sound approach and an opportunity to help preserve these great institutions. Oklahoma Gas & Elect. Co. has a vital interest in the progress of education, an interest that comes from both our responsibility as a corporate citizen and our interest in employing graduates of high ability and training. Therefore, it is a voluntary interest and goes beyond the use of our tax dollar."

And, Pacific Gas & Elect. Co.'s V-P Gerdes observes: "Increasingly, our future depends upon the quality of our institutions of higher learning, both public and non-tax supported. Only with the financial support of our citizens, including corporations, can their needs be met."

An IFCA trustee, Kentucky Utilities Co. Chairman R. M. Watt points out that utility management should not be deterred from participation in the cause of financial aid to colleges because the industry is regulated both locally and nationally. He offers these as his reasons for support:

"1. The supply of educated personnel is as essential to economic growth as is the supply of material. The cost of producing this personnel is just as important a part of doing business as the cost of material. This is recognized by the income tax law which provides deductions for both items.

R. M. Watts

"2. Business and industry, operating and expanding to satisfy today's and tomorrow's demands, must recruit highly educated personnel to fill future needs.

"3. Inflationary conditions now existing have saddled the private colleges with a burdensome handicap. They are forced to compete with business and industry for talented people and for adequate facilities when their endowment incomes are suffering deflation.

(Continued on page 93)

College-business exchange program sponsored by the Foundation for Economic Education this year granted 65 fellowships to professors from 58 different colleges. Economics Instructor Jerry Lee Jones (left) spent six weeks at the general office of West Penn Power, whose president S. L. Drumm, is shown presenting the Bethany College (W. Virginia) professor with a participation certificate. Fifty U. S. firms granted the fellowships.

NUCLEAR NEWS

TARTUP TIME NEARS for several nuclear power projcts: Construction at *Indian Point* in N. Y. is all but nished, with cleanup efforts now in progress; at *Elk iver, Minn.*, the Rural Coop Power Association's eactor is being readied for criticality—possibly in ie next few weeks; at *Hallam, Neb.*, the Consumers ublic Power Dist. project is more than 90-percent n the way to completion and criticality in mid-'62 but has been producing from 40,000- to 80,000-kw f electricity with coal or gas as fuel since last une). Meanwhile, construction work may be finhed next month at *PRDC project* in Monroe, Mich. well ahead of the completion date of Dec. 15, 1961, fter an extension by the AEC.

BSERVERS IN WASHINGTON still view the nation's rogress toward competitive nuclear power as someiing short of on schedule. Referring to the AEC-stablished goal (with a target date of 1968 for cometing with conventional fuels in high cost areas of ie U. S.), critics of the contributions of private inustry continue to express fear that critical months ust ahead cannot be passed without more starts on rge-scale projects. But, whether or not the AEC ill resort to offering the "additional incentives" it as had under study remains to be seen.

HE "COMPETITIVE" GE LINE of boiling water reactor lants, carrying nominal ratings up to 500,000-kw, epresents something of a guarantee that industry ill meet the target date, even the critics may conede . . . but, they add that "such an offer to sell does ot guarantee a utility company to offer to buy."

TOMIC INDUSTRY EMPLOYMENT characteristics tell uite a bit about the state of the industry—it remains ghly technical, with concentration on R & D conuing. A recent Labor Dept. survey shows that out one-third of 126,000 workers employed by ajor AEC contractors in 1960 were engineers, ientists and supporting technical workers. Highly illed craftsmen accounted for about 20-percent, hile the most common single occupation was the echanical engineer.

VIGOROUS" BIDDING FOR INSURANCE in the nuclear dustry exists now, according to a witness who rently denied anti-trust violation possibilities before e JCC. The general counsel for the Associated actory Mutuals of Providence, R. I., A. B. Kelly, stified that his company is a "vigorous participant" competition between stock and mutual firms.

S.-EURATOM CONTRACTS with SENN now cover e first joint power project, involving the Italian ility's 150-mw boiling water reactor being built by eneral Electric.

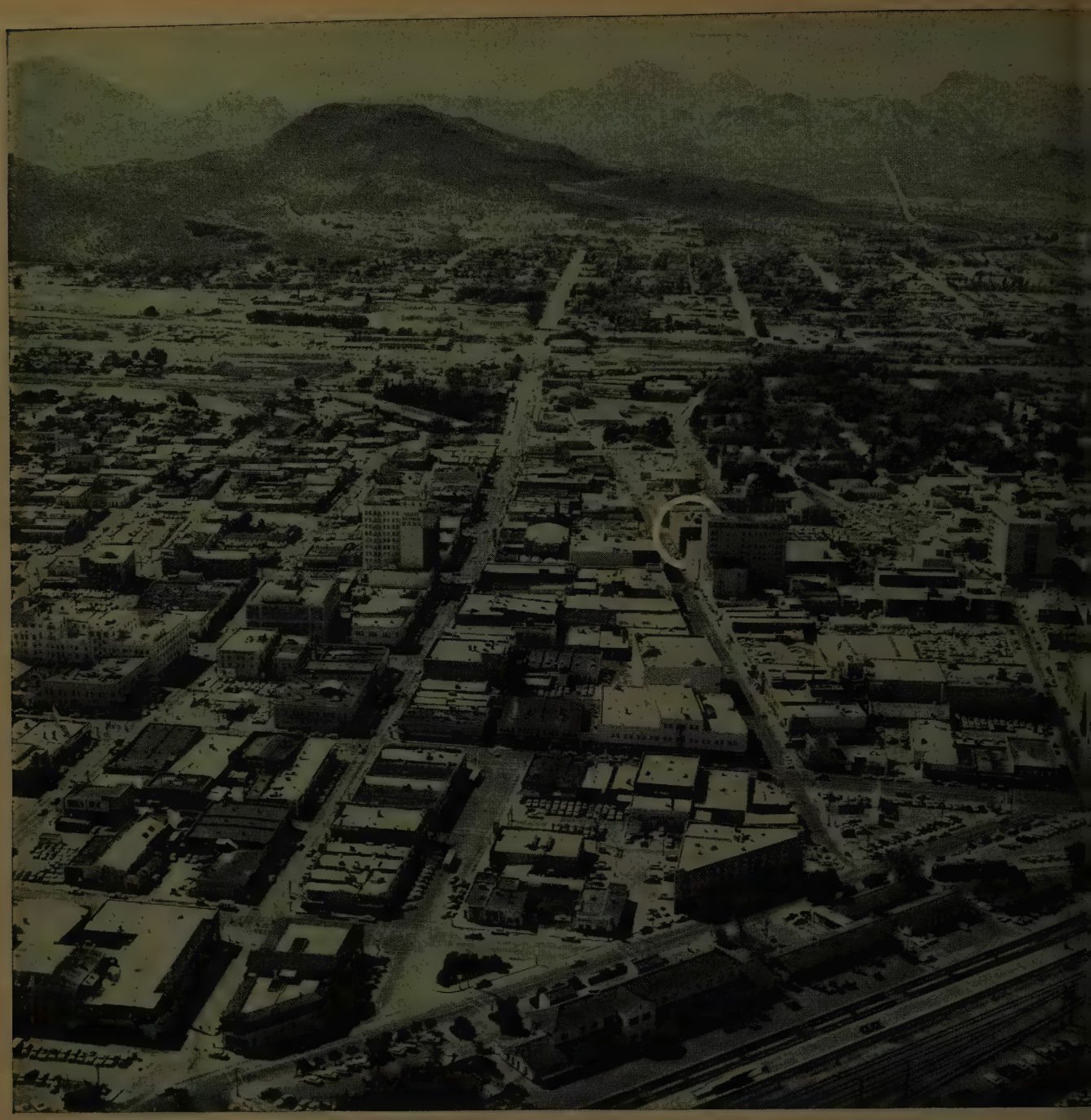
CIENTIST AT HEAD OF IAEA beginning Dec. 1 repreits a compromise with other nations in the inter-

Conventional powerplant look of this nuclear station design results from elimination of the already familiar containment sphere required in the earliest atomic powerplants. General Electric, which recently announced availability of a full line of units in ratings up to 500-mw, offers pressure suppression containment in the sizes up to 400-mw.

national agency. Dr. Arno Sigvard Eklund of Sweden is a nuclear physicist and reactor expert, as well as a representative of a neutral nation. Retiring Director General Sterling Cole is, of course, a politician from the U. S., where he formerly headed the Joint Congressional Committee on Atomic Energy.

LATEST LITERATURE LEADS: From Commerce Dept., OTS, Wash. 25, D. C.—*"Experimental Organic-Cooled Reactor Conceptual Design,"* by W. E. Nyer and J. H. Rainwater (Phillips Petrol. Co.) for the USAEC, 242 pages, $2.50; "Preliminary Design of a basic Radiation Effects Reactor (BRER)," by D. R. MacFarlane and others (ANL), 61 pages, $1.50.

Portable nuclear powerplant is due to begin power production at this site at Air Force Base near Sundance, Wyoming, the first of October. The Martin PM-1 was shipped from Baltimore in 16 packages. (The Martin Co. also has a design contract from the Army Engineers for a 10,000-kw plant for Liberty ship installation.)



Sunshine City

This is Tucson, Arizona, where the skies are azure and the sunshine sparkles day after day, all year round.

This is Tucson whose exciting past is filled with Spanish missionaries, Indians and cowboys . . . and which now boasts a university, an electronics industry, an air base, and myriad other assets . . . all set amid surroundings perfect for work or play.

Famous Supima cotton is grown in the same valley. Dude and cattle ranches abound. Mexico lies only 65 miles to the South.

Little wonder Tucson has grown from 262nd to 54th in rank among U.S. cities in the past ten years.

Tucson lies athwart the main line of one of the nation's leading railroads . . . and is served by the Tucson Gas, Electric Light, and Power Co., a fast-growing modern utility whose offices are circled in the photo above.

And supplying the needs of both utility and industrial users is Kerite Cable.

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it's the KERITE *that makes the difference*

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F. P. C. Claims Jurisdiction Over Resale Rates of So. California Edison Co.

In this proceeding the city of Colon claimed that the Public Utilities ommission of California had no gal right to set the rates for power hich Colton purchased from the dison Company and that only the P. C. had jurisdiction. The argument was based on the fact that the holesale of power by Edison for sale by Colton was a transaction interstate commerce since some the power sold to Colton was obined by the Edison Company from utside of California. These sources power were specifically the Hooer and Davis Dams on the Colodo River.

The claims of Colton were supported by the staff of the F. P. C. d opposed by both the Southern alifornia Edison Company and by e P. U. C. of California.

The Question of Jurisdiction

On the question of whether or not e P. U. C. had jurisdiction over e sales of the type made by the dison Company to the City of Coln, the presiding examiner of the P. C. ruled in favor of the Calirnia Commission. The opinion of e F. P. C. noted that:

The staff excepts saying that this igores the Attleboro case . . . holding that state may not constitutionally regulate wholesale of electric energy in interate commerce. Colton likewise argues at the states are powerless to act in this tuation and nothing in the legislative story, to which we have already rerred, shows that Congress intended to ncede to the states an essentially naonal power.

In our opinion the sale by Edison of t-of-state energy to Colton, as is shown be the case hereafter, is a sale at olesale in interstate commerce and may t be regulated by the State of Califora as held by authorities too numerous to te. . . . . The sale, on the other hand, subject to our jurisdiction under Secn 201 of the Federal Power Act, which as enacted to close the "gap" in regulan created by the Attleboro case. There a persuasive analogy here between Secn 6 of the Boulder Canyon Project Act d Section 20 of the Federal Power Act, which appeared to give the states jurisdiction over the sale of power produced at a licensed project. Section 20 was held not to except licensed project power from the jurisdiction of this Commission over interstate sales at wholesale subject to Part II of the Power Act. United States v. Public Utilities Comm'n., 345 U. S. 295, 303-304.

In their exceptions Edison and PUC argue that the examiner should have found that all of the facts and circumstances surrounding the sale here disclose that the transaction is a matter of local concern that does not involve the interests of the United States or of any state except California because the United States is the party selling the energy. Therefore, Edison argues, the Attleboro case does not apply; there is no Attleboro "gap" and the PUC takes jurisdiction because Section 201 (a) of the Power Act provides that Federal regulation is "to extend only to those matters which are not subject to regulation by the states."

In our opinion the field of wholesales of electric energy in interstate commerce has been held to be outside of the constitutional scope of state regulation. United States v. Public Utilities Comm'n., 345 U. S. 295. The Attleboro case does not limit the rule to cases where it can be specifically shown that other states are affected. When the Federal Power Act was enacted, the Congress assumed that all such sales were exempt from state regulation."

Facilities Serving Colton

It was the contention of Southern California Edison Company that the service rendered to Colton was by means of local distribution facilities and consequently that fact exempted the company from F. P. C. jurisdiction.

The opinion of the F. P. C. stated however that:

"In our opinion even if Edison is factually correct about the nature of the facilities, its point is not relevant under the Federal Power Act. Since the sale to Colton includes Hoover energy, it is a sale at wholesale in interstate commerce subject to our jurisdiction regardless of the nature of the facilities used to make the sale. Section 201 (b) excludes from our jurisdiction facilities used in local distribution, but that is not the question here. The Connecticut Light and Power case, ... cited by Edison involved the question whether the company was a "public utility." The Court held it was necessary to find that certain facilities used to serve Bristol, Connecticut with out-of-state energy transmitted by another company were not used in local distribution before it could be determined that the company was a "public utility" owning facilities subject to our jurisdiction. Here, of course, there is no question of Edison's status. It transmits Hoover Dam energy that it receives at Hayfield and is thus a "public utility" subject to our jurisdiction."

The Effective Rate Schedule

The Federal Power Commission voted that the Edison Company had never filed a rate for service to Colton and that it is required to do so under the Federal Power Act.

The F. P. C. went on to say that interstate energy was being delivered to Colton by July 1954 and that:

"On that date the 1945 contract was in effect and embodied the agreement between the parties as to the rates. We shall therefore, consider the 1945 contract as embodying Edison's rate that should be filed in compliance with the Act. Any change made after that date was required by Section 205 (d) of the Power Act and our Regulations to be filed with us, and in the absence of a filing such change was ineffective."

The Commission opinion continued:

"Edison argues further that Colton by its course of action intended to be contracturally bound by the rate modifications prescribed by PUC. Edison points out that Colton did not contest the PUC's jurisdiction before it accepted the 1954 rate increase without protest, although protesting the 1957 increase, and did not attempt to terminate the ten year 1945 contract in 1955 as it was priviliged to do according to its provisions. In our opinion conformity without protest to the asserted authority of the rate regulating body of the state does not result in a contractural adoption of its unauthorized orders. This is very different from free bargaining between two contracting parties. Colton's failure to terminate the contract likewise appears to be without significance because its only source of power is Edison, and the rates were regulated by PUC."

* * *

(Continued on page 94)

SOLID EXPERIENCE *plus* INGENUITY in engineering and construction. Vital to your new plant's maximum profitability —and KE is headquarters for both!

To years of major plant design and construction experience, KE adds the other vital ingredient—ingg Ingenuity in design and in construction, to give you a better plant, sooner. Ingenuity that ranges from innovations to sophisticated analysis by KE computers in such applications as profitability and open studies, critical path scheduling, linear programming, simulations by Monte Carlo methods, process b and materials handling calculations, heat balance and steam flow calculations, and reactor design c erations. In Steel, in Minerals, in Power Generation, in the Nuclear field—Kaiser Engineers' expe and achievements are substantial. A call from you will bring a specialist in your field to summarize KE has done for others, can do for you.

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Revere Copper Plates Serve in MHD System

Copper plates produced by Revere Copper and Brass Incorporated serve a major function in the revolutionary new magnetohydrodynamic (MHD) system of electric power generation developed by Avco-Everett Research Laboratory. An experimental generator now in operation has produced 205 kw of power, it was recently announced.

The electromagnet for the generator of the new system consists of 22 tons of Revere copper plates which are connected to form a coil, and 25 tons of iron pole pieces.

When perfected, the system is expected to provide an important new source of electrical power. Twelve leading utility companies have joined the Avco-Everett Research Laboratory in underwriting research studies to develop the new system which has an anticipated conversion efficiency of 60 percent, compared to the 35-40 percent conversion efficiency of conventional generators.

Hollow Conductor Rotors Cool Slipring Motors

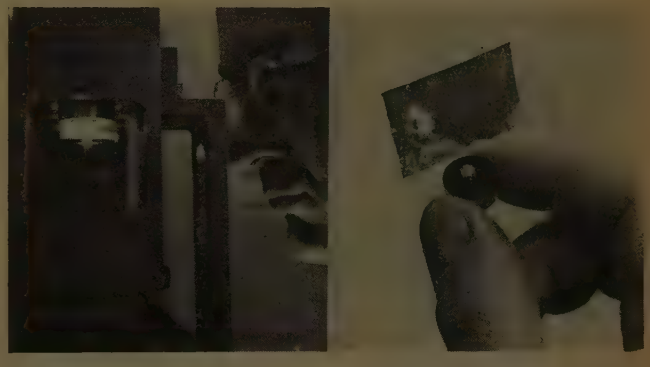
Hollow conductor rotors are being used by English Electric to provide direct air cooling for high speed, large slipring motors. Designed primarily for driving boiler feed pumps, these motors can also be used for other high speed industrial drives needing speed variation and/or a low starting current. The new English Electric design effectively disposes of a cooling problem posed by the use of the variable speed drive—often required today, with the higher pressures and larger sizes of centrifugal boiler feed pumps. English Electric's solution is to allow air to enter at both ends of the conductors which are made from hollow rectangular section copper. This keeps the end windings cool and at the same time increases the efficiency of the motor by reducing to a minimum the quantity of cooling air required.

VHF Radio Networks Help Locate Remote Electric Outages

Very high frequency (VHF) radio networks are now being utilized to locate remote outages of electrical power. The electric outages are swiftly relayed to a central station, which in turn relays them to repair crews, and power often is restored before customers are aware of the outage, Martin Cooper, Motorola, Inc., reported at a communications system symposium during the Pacific General Meeting of the American Institute of Electrical Engineers.

The system consists of a decoder-printer at system headquarters and a group of remote transmitter-coder units at unattended circuit breakers throughout the system. The transmitters are connected to the line side of the circuit breakers "so that power is still available when an overload on the load side causes the breaker to open." In case of an overload, an actuator switch and the operating cycle of the transmitter-coder is started. It transmits a tone-coded message, identifying the breaker by number. The message is repeated once per minute for five minutes, to insure receipt at headquarters where a permanent paper tape record is kept. The information is then relayed to the repair crews.

Westinghouse Scientists Fire Supersonic Water 'Bullets' Into Steel



Westinghouse research scientists are shooting "bullets" of water into solid blocks of steel. Traveling at velocities up to 3400 mph, drops of water can penetrate thin pieces of metal like a rifle bullet.

Purpose of these experiments is to study the action of water droplets upon the rapidly spinning blades of a steam turbine. This work was described at an American Society of Testing Materials (ASTM) symposium on erosion by S. M. DeCorso and R. E. Kothmann of the Westinghouse research laboratories, Pittsburgh, Pa.

Over a long period of time, drops of water in moist steam erode the leading edge of a whirling turbine blade. The Westinghouse experiments study this complex erosion process in its simplest, most easily understood form. Single drops of water, fired at metal surfaces under carefully controlled conditions, replace the countless drops moving about, with unknown speeds and directions, inside a turbine.

NEW PRODUCT DESIGN

Reduce Size, Weight of Power Capacitors

Smaller and lighter power capacitors by, from left to right, General Electric, Federal Pacific Electric Co., and Line Material Industries are representative of a major advance in power capacitor design and manufacture.

A significant advance in the design and manufacture of power capacitors, effecting reductions in unit size and weight, and making possible more kvar per pound per cubic inch, has been announced almost simultaneously by several suppliers.

General Electric, for example, has a new 100-kvar power capacitor weighing 132 pounds and occupying 2050 cubic inches. Comparable size and weight reductions are also available in G.E.'s new 50-kvar capacitors.

Similar economies are afforded by **Federal Pacific Electric Company's** new 100-kvar "Tiny Tim" Capacitor. This unit weighs 115 pounds with case dimensions of 4½ x 13½ x 28¼ in. and an overall height of 36½ in., the company says. The 50-kvar "Tiny Tim," says Federal Pacific, weighs 62 pounds with a case height of 15 in. These units are rated at 2400 v through 7960 v, 60 cycle, single phase, with single or double bushings.

New 50-kvar capacitors from **Line Material Industries** feature a reduction in weight from 91 to 70 pounds with tank dimensions of 4 x 13½ x 20½ in. and rated 2.4 to 14.4 kv. Line Material expects to provide a 30 percent reduction in weight of its 100-kvar unit.

Earlier announcements of power capacitor size and weight reduction were made by Allis-Chalmers Mfg. Co., Ohio Brass Co., Sangamo Electric Co., and Westinghouse.

Circle item #1 on reply card

Metalized Plastic Film

A rubber-based adhesive provides the "steel grip" required for development of, the company says, a new, highly-reflective metal that can be bent, drilled, punched, crimped or formed for a wide variety of uses. Various types of lighting reflectors, decorative trim for radio and TV cabinets, and appliances are among the many uses predicted for a specular or optical finish reflector sheet called "Dynasyl" developed by the **W. J. Ruscoe Company.** Dynasyl consists of metallized polyester plastic film permanently bonded to aluminum sheet with a high-strength adhesive produced by **Goodyear's Chemical division.**

Circle item #2 on reply card

Elbow-Derrick-Digger Unit

Holan Corporation is offering an optional earth borer that converts the Holan HV Elbow into an all-purpose utility tool. A specially-designed attachment near the end of the lower boom of the Elbow accommodates the Holan 5400 earth borer, enabling the unit to bore holes as far as 13½ feet from either side of the truck body. Because the Elbow rotates 360 deg continuously in either direction, the digger and derrick can be operated behind and on either side of the truck. Used as a derrick, the elbow can winch and live boom from 4,000 to 6,000 pounds, at head heights up to 27 f 10 in. at 8-ft radius, plus an additional 6 ft if extension is used, the company says.

Circle item #3 on reply card

Double-Break Switch

Memco Engineering & Mfg. Co Inc. has introduced a new center

rotating, double-break group-operated switch. Designated as the R-17, the switch is available in nominal ratings from 34.5 kv to 34 kv and in 600, 1200, 1600 and 200 amp continuous.

The Magne-Loop contact jaw now standard on all Memco vertical-break switches has been adapted for use on the R-17. The blade rotating mechanism is covered with a sturdy shield to protect against ice and sleet.

Circle item #4 on reply card

Conductor-Cutting Power Tools

Two new power tools for cutting electrical conductors have been de-

veloped by the **A. B. Chance Company.** One tool is used for cutting single core ACSR on line construction and maintenance work while the other is used to cut through heavy copper stranded conductor. Both tools are available with mechanical fittings for hydraulic-power source operation.

Circle item #5 on reply card

Economy Grade Silicone Plate

New grade, silicone plate, H-9758, has been developed by **Westinghouse Electric Corp.** for general applications requiring class "H" insulation temperatures. Possible applications include transformers, barriers, rotating apparatus, coil washers, slot wedges, slot filler strips, coil end turns, spacers and hangers. The material has a dielectric constant of 4.8 to 4.9 at 1 mc, an arc resistance of 180 seconds, surface resistance of 100,000 megohms, and volume resistance of 10^7 megohm-cm, the company says.

Circle item #6 on reply card

Portable Two-Way Radio

General Electric Company has announced a new personal portable two-way radio described as the smallest, lightest, most compact VHF-FM man-carried communications unit to be marketed to date with the transmitter and receiver in a single case. The new personal communication units will be manufactured for high band frequencies (132-174 mc.) with one-watt transmitter rf power output. Called the "Voice Commander," the new equipment is 9.5 inches high, 5.3 inches wide and 1.7 inches deep.

Circle item #7 on reply card

"linemen's dream" ...from any angle!

SR MODEL XS-100 UNIVERSAL STRINGING SHEAVE
with adjustable crossarm bracket

On Crossarm

VERTICAL 22½° 45°

67½° 90°

On Crossarm With Added Angle Attachment

In Suspension

With Pole Bracket

67½°-90° Angle Attachment and Pole Bracket are accessories.

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COMPANY_____
ADDRESS_____

NEW Products

BIDDLE INSTRUMENTS Since 1895

Conductor Phase Identification Set Saves Labor Costs

on Phase Determination and Conductor Identification on Underground Cable Systems

The Biddle Conductor Phase Identification Set employs a unique circuit that provides positive and reliable identification *without the need for removing all safety grounds.* Transmitter can be operated from either 60-cycle supply or self-contained dry cells. The detector is similar to a clamp-on ammeter. When clamped around A phase conductor, the pointer deflects left; when clamped around B phase conductor, it deflects right; when clamped around C phase, there is no deflection. Pick-up coil and earphone unit is used with transmitter to identify the cable itself. This means of positive cable identification results in safer operations and reduced labor costs.

Write for BULLETIN 82EL

Complete set includes transmitter, phasing detector and cable identification detector.

Biddle-Balsbaugh Test Cell Kit for Liquids

This kit is used with a Megger insulation resistance tester to make resistivity measurements of insulating oils and other liquids. Useable at test voltages up to 5,000 volts d-c. For complete details—

Write for BULLETIN 21-OCEL

B109

JAMES G. BIDDLE CO.

Electrical and Speed Measuring Instruments

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Station Post Insulators

A complete new line of Locke stacking station post insulators fea-

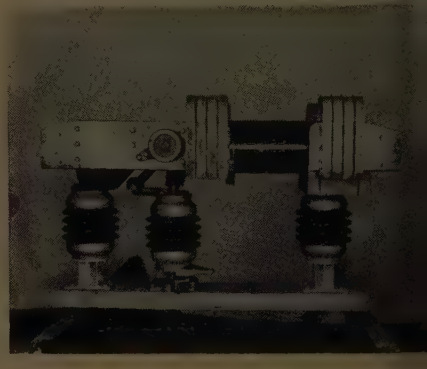
turing, the company says, a metal polymer seal which prevent air-moisture leakage has been in troduced by **General Electric Com pany's Insulator Department.**

Available in standard, hig strength and extra high strengt BIL ratings of 550 kv through 147 kv, the station post insulators ar designed for use on switches, as bu supports, etc. on system voltages 115 kv through 345 kv.

Circle item #8 on reply card

Disconnecting Switch

Large size, great cross-section an overall massiveness are the feature



of type G-45 Air-Break Disconnec ing Switch by **USCO Power Equi ment Corp.** The G-45 has a curre path of bus-bar copper devoid casting, and according to the co pany, is qualified for a rating of 50 amp. It has high-pressure line-ty contact, silver-to-silver, in the hin as well as the jaw. A variety of te minal-pad arrangements are avail ble, the company says, to meet t customer's special needs.

Circle item #9 on reply card

Arc Eliminator

Erie Fan & Blower Co., Inc. has perfected a low-cost, easily installed device to eliminate arcing in Johnson Dead End insulators, the company says. The device is a small brush having phosphor bronze bristles and a brass wire core. Inserted in the J. D. insulator joint, the bristles of the brush pierce the corrosion and make an electrical bond between the metal parts. Springing action of the bristles is sufficient to maintain a tight bond and to hold the brush in position indefinitely, the company says.

Circle item #10 on reply card

Insulation Test Set

Both high voltage breakdown tests and insulation leakage measurements may be made with the model 8527 Test Set developed by **Associated Research, Inc.** The hypot section provides a-c potential that is continuously variable from zero to 1.5 kv for breakdown testing, the company says, with separate read-out lights to indicate breakdown and leakage current above a present value. Other models are available with higher a-c or d-c test potentials.

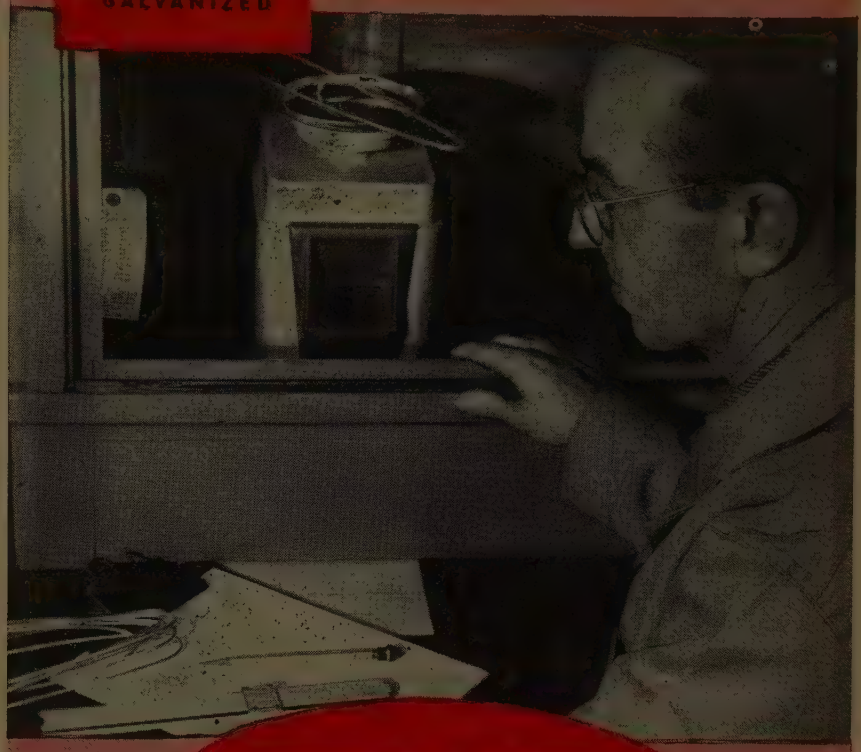
Circle item #11 on reply card

New Cabinet Actuator

Woodward Governor Company has announced the addition of an electric-hydraulic cabinet actuator to its complete line of mechanical-hydraulic governors. This new unit is the first production governor by Woodward not employing the familar fly weights as the speed sensing elements of control. Static electrical components replace such devices as the ballhead assembly and temporary droop dashpot.

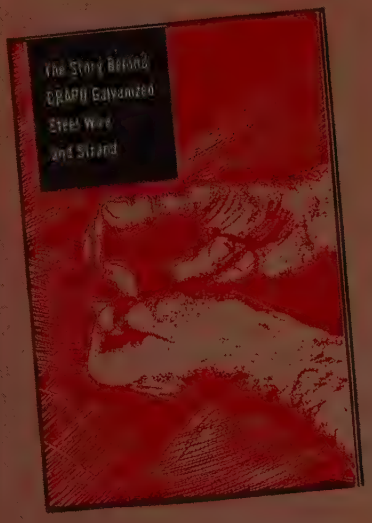
Circle item #12 on reply card

Crapo GALVANIZED STEEL STRAND



WEIGHT OF COATING TEST

...added assurance of dependability



The life of galvanized steel strand depends primarily upon the weight and quality of the zinc coating. The heavier the coating the longer the strand will last.

The wire used in CRAPO Galvanized Steel Strand is regularly subjected to the hydrochloric acid antimony chloride, or weight of coating, test. By means of this test the amount of zinc on the surface of the wire can be accurately measured.

This is but one of the many laboratory tests to assure consistently high, dependable quality in the finished product.

AVAILABLE IN 3 COATING WEIGHTS

CRAPO Steel Strand is regularly furnished in all standard sizes and grades and in Class A, B and C coatings. Class B coating is twice as heavy as Class A coating; Class C coating is three times as heavy.

Write for this FREE BOOKLET!

"The Story Behind CRAPO Galvanized Wire and Strand" describes and illustrates manufacturing and testing techniques. Ask for Booklet B-59!

INDIANA STEEL & WIRE CO., INC.
Muncie, Indiana

MEN OF POWER

Directors of Iowa Electric Light and Power Company, at a recent meeting, have elected **Sutherland Dows** chairman of the board and **Duane Arnold** president. Mr. Dows, who has been with the company for 47 years, has been president since 1941 and will continue as chief executive officer.

Mr. Arnold has been with the company for 15 years. In 1950 he was made vice president in charge of operations, later promoted to vice president and general manager, and most recently, elected a director of the company.

* * *

Recent changes at San Diego Gas & Electric Co. include the election of **Lewis R. Knerr**, formerly rates and valuation manager, as vice president, management services.

He held engineering positions with Great Western Power Company, and Pacific Gas and Electric Company before serving with the California Public Utilities Commission as associate engineer. He later became senior and supervising utilities engineer in the Commission's gas and electric divisions. He has been with San Diego Gas & Electric as manager of Rates and Valuation since 1956.

* * *

John W. Burg, division superintendent for The Connecticut Light and Power Company's central division, has been named to the new post of division superintendent for CL&P's Housatonic division.

He started his utility career in 1930 as a cadet engineer. In 1937, he was made district engineer, and later was assistant gas superintendent for the Company, becoming central division superintendent in 1954.

Thomas F. Keena, district engineer for the Company's Essex district, will succeed Mr. Burg as central division superintendent.

* * *

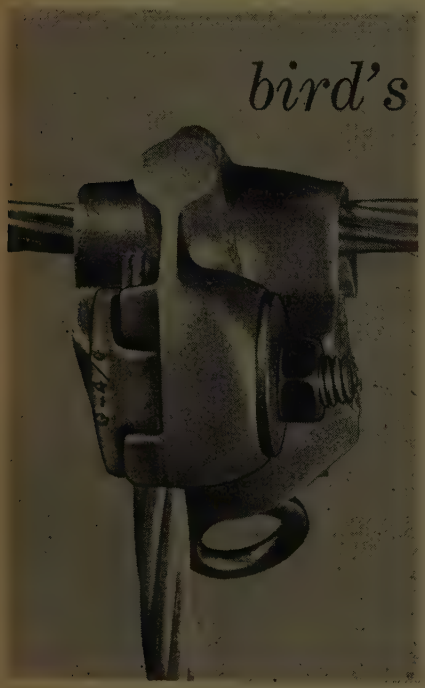
Wisconsin Electric Power Company has announced the promotion of **R. A. Niles** to chief distribution engineer, succeeding **A. G. Pergande,** who retired last July. Mr. Niles joined the company in 1948 as a junior engineer, and later was named assistant to the manager of electrical operations.

Niles

Kenneth E. Wolters will succeed Mr. Niles as assistant to the manager of electrical operations. Mr. Wolters, who joined the company in 1950, has been assistant superintendent of the electrical testing and meter division.

* * *

The board of directors of Public Service Company of Indiana, Inc. has elected **Walter J. Matthews**



bird's eye view of a cool running hot tap for ACSR...

with a 9051 aluminum clamp

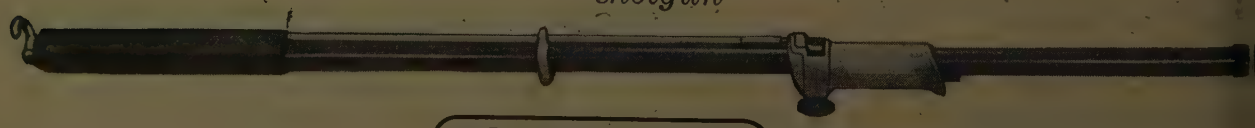
The 9051 is WIDE . . . 2⅛" . . . conductor grooves are deep, wedge type for greater contact surface and pressure. Stainless steel Bellevilles on both line and tap compensate for "conductor relaxation".

installed with

BODENDIECK

Medallion fiberglas shotgun

The world's finest shotgun stick thoroughly field proven through years of use. Light strong and smooth working.



BODENDIECK TOOL CO., TAYLORVILLE, ILLINOIS

executive vice president. He will be in charge of operations, and will take office in October.

Mr. Matthews has had 25 years experience in the electric utility industry and he is now operations manager for Virginia Electric & Power Company, Richmond, Va.

* * *

C. Perry Griffith, treasury service supervisor of Indianapolis Power and Light Company, has been promoted to administrative assistant for public relations. **William I. Spencer,** an internal auditor, succeeds Mr. Griffith as treasury service supervisor.

* * *

Changes in the executive structure of several companies of the New England Gas and Electric System were announced recently.

Fred M. Rowell, vice president and general manager of **Cape & Vineyard Electric Company,** will relinquish the position of general manager on October 1 to become a vice president of New Bedford Gas and Edison Light Company. He will continue as vice president of the Cape & Vineyard company.

Carl T. Ohrn has been appointed general manager of Cape & Vineyard Electric Company, effective October 1, when he will assume active direction of the operations of the company. He is presently superintendent of transmission and distribution at Cape & Vineyard.

Succeeding Mr. Ohrn as superintendent of transmission and distribution on October 1 is **Preston H. Morris,** electrical engineer for Cape & Vineyard Electric Company.

Assistant General Manager of Cambridge Gas Company, **John C. Stoneman,** has become assistant general manager of Worcester Gas Light Company.

* * *

Niagara Mohawk Power Corporation has just organized a new system sales staff comprising seven managerial positions. The staff will centralize the formulation and direction of new sales policies and extensive sales promotion programs throughout the 22,000 square miles served by the Company's three operating Divisions. **Osborne B. Nye** has been named system sales manager, in charge of the new staff. Newly-appointed staff managers are

SAVE up to $1.25
ON EVERY POLE YOU TREAT

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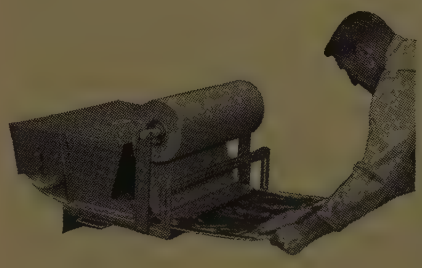
NDKator DOES IT! CUTS COSTS! ELIMINATES WASTE!



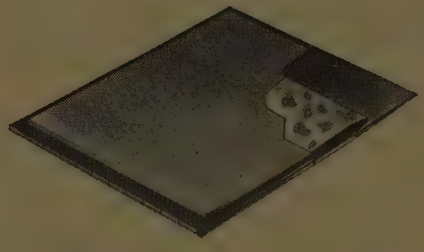
Utility poles cost money. And it costs money to preserve them, too. But why add *unnecessary* expense to that vital ground-line preservative treatment?

Initial cost of a "factory made" pole bandage is approximately ONE DOLLAR MORE than the cost of a "do-it-yourself" bandage made with Androc's new and exclusive **NDKator** bandage maker — a simple-to-operate machine that positively eliminates waste because your crewmen make bandages of the *exact size* required for each pole they treat.

Remember, too, that EVERY INCH WASTED WITH A "FACTORY MADE" BANDAGE COSTS YOU 7 TO 8 CENTS!

How much will *you* waste this season with factory made bandages?

NDKarrier FOR PORTABILITY "ON-THE-SPOT" CONVENIENCE!



Your field crews have been begging for this!

Isolated, hard-to-get-at poles now can be treated just as easily as those in accessible locations. Using the **NDKator,** make bandages of exact size right on the truck, place them in the **NDKarrier,** carry across fences or ditches and treat poles. No need to lug preservative containers and other heavy equipment to the job — each **NDKarrier** unit holds two prepared bandages, and a sturdy handle makes it easy for crewmen to carry several units at a time. Crews can treat many more out-of-the-way poles every hour with this remarkable Androc **NDKarrier.**

"TWIN" AGENTS — NDK and NDK-3

Androc **NDK** preservative contains 10% penta, one of the two wood preservatives approved for original pole treatment. Low viscosity oil carrier provides deep penetration . . . high distillation range keeps it there. No evaporation —no "blooming" of penta crystals. **NDK** produces best results when applied with **NDKator** in ground-line treatment.

Androc **NDK-3** contains the same basic 10% penta as does its twin product, **NDK.** In addition, it includes 15% Grade 1 coal-tar creosote and 10% sodium fluoride. Like **NDK,** it is stable and remains intact without bleeding, separation or change in consistency during long storage periods and under extreme temperature ranges. For most effective application, use with **NDKator.**

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61-B

Lawrence B. Carney, sales training; **O. Mark DeMichele,** advertising; **Coburn D. Hollister,** commercial sales; **Walter J. Stepien, Jr.,** industrial sales; **Donald E. Vincent,** residential sales, and **Kenneth C. Whyland,** service. They will headquarter in Syracuse.

* * *

R. J. Douglass, formerly vice president and regional director for Westinghouse Electric Company, S. A., in Buenos Aires, Argentina, has been elected president of Westinghouse Electric International, S. A. (WEISA), Geneva.

Mr. Douglass has been associated with Westinghouse since 1939, having served as a transportation and generator engineer in Pittsburgh, Pa., later as an application engineer in New York, becoming vice president of the Westinghouse subsidiary in Argentina in 1959.

* * *

Dane T. Scag, formerly technical director of C Stellarator Associates, Princeton, N. J., has been appointed assistant director of research, Allis-Chalmers Research Division. Mr. Scag joined Allis-Chalmers in 1946 as a consultant and design engineer in the betatron laboratory. Prior to that he was an instructor on the research staff of the cyclotron laboratory at the University of Illinois. A joint recipient of the Comstock Award in 1946, Mr. Scag was instrumental in developing the betatron as a device for use in industry, therapy and research.

* * *

Robert Lee Sawyier, Jr., formerly chief illuminating engineer, has been appointed director of commercial sales for Pacific Gas and Electric Company. Mr. Sawyier will have responsibility for planning and guiding the company's program of gas and electric sales to commercial establishments throughout the system. He succeeds **Stanley O. Blois,** recently named Colgate Division commercial manager.

* * *

G. W. Fugate and **J. William Sanders** have been named assistant sales managers at Central Transformer Corporation. Prior to joining Central in 1959, Mr. Fugate served as sales engineer with Nelson Electric Manufacturing Com-

pany of Tulsa, Okla. His experience includes two years in sales for Pure Oil Company, Tulsa; and two years as production superintendent for Stekoll Oil Company, Tulsa.

Mr. Sanders was with the Apparatus Sales Division of General Electric at Amarillo, Texas, before he joined Central in 1960. After completing G. E.'s Technical Marketing Program, he served as a sales engineer.

* * *

Succeeding **Lansing T. Smith, Jr.** as president of Gulf Power Company is **Robert L. Pulley,** formerly vice president and general manager. He started with the company in 1925, and after becoming chief engineer, then operating manager, he was elected a vice president. He became general manager last year.

Assistant General Manager, **Robert F. Ellis, Jr.** has been elected vice president.

* * *

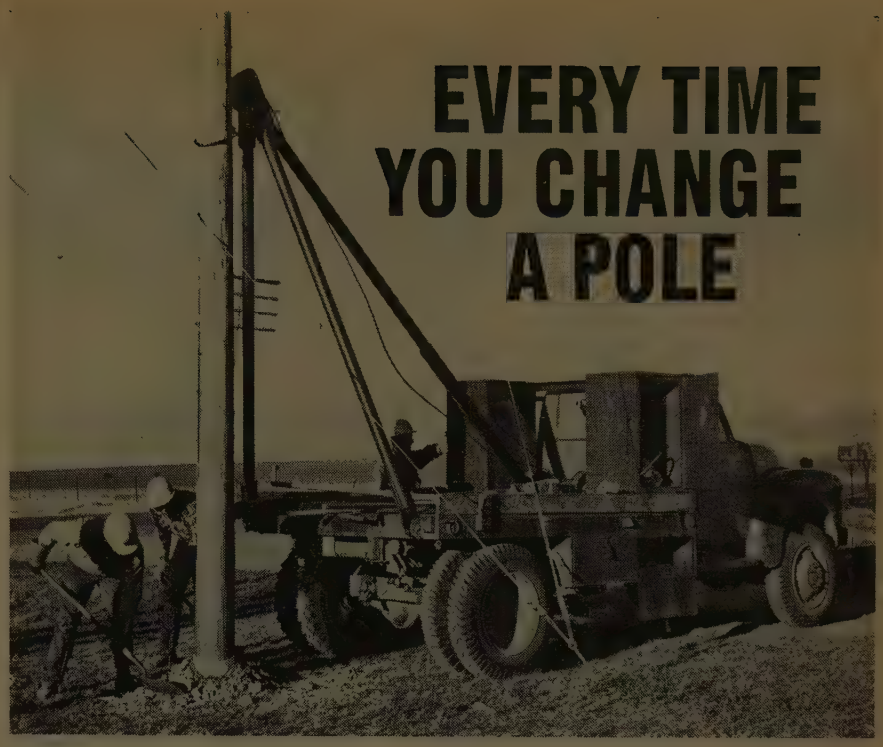
Frederic Cox, for the past five years Metropolitan Edison Company's Western Division (York) manager, has been elected a vice president of the company. His appointment was announced after a recent meeting of the company's board of directors in Reading, Pa.

After having been named superintendent of electrical construction and maintenance in Easton, he was promoted later to the position of superintendent of distribution in the Easton line department. He became division operating superintendent in Easton, and later he was named general superintendent of transmission and distribution in the Central Division (Reading).

* * *

Hermann F. Bottcher has been named director of manufacturing and operations services for the management consulting division of Ebasco Services Inc.

He was formerly a senior consultant on Ebasco's New York office staff. Before joining Ebasco, he held manufacturing and engineering posts with E. R. Squibb & Sons and Aluminum Company of America. He succeeds **John D. Cassidy** who has been named director of industrial management consultation for the division.



Protect it with a POL-NU® PAK

When a pole is removed from one location and re-set in new earth it is subject to rapid decay and insect attack at the critical ground-line area. Renewal of preservative protection is vital to obtain longest possible service life.

The Chapman Pol-Nu Pak makes it easy for line crews to apply ground-line preservative to "road-moves" and poles being returned to service. It is an envelope-type bandage containing Chapman Pol-Nu, grease-type preservative which gives long-lasting protection.

Pol-Nu Paks are available in several sizes and, because of their convenience, are often preferred for down-the-line treatment of standing poles. Factory sealing of the Pak always insures the proper amount of preservative application for maximum protection without waste. The photos below show how easily it is applied. Mail coupon for data.


Slit Pol-Nu Pak on three sides to expose preservative.


Wrap bandage around pole at ground-line and staple.


Back-filling completes job, assuring longer pole life.

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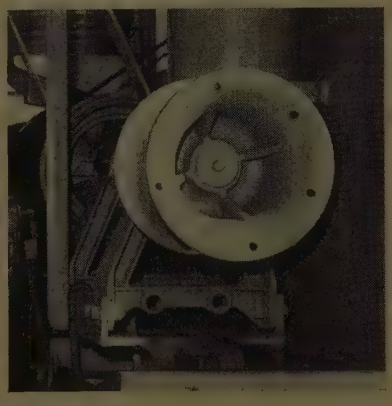
This International R-190 truck uses a model 34 Tulsa Winch operating with a hydraulic boom. The truck is one of the 2,850 vehicles used by the Southern California Edison Company to service more than 20,000 square miles in the Southern California area.



strength & stamina that spell savings

There's more room for pay load because a Tulsa Winch is compactly designed. This winch packs a terrific pull even though weight has been trimmed to the bone. More shock load is absorbed, and more operating efficiency is delivered by Tulsa's specially designed worm and gear. You have less engine wear and lower fuel bills since you use less horsepower to move a given load. Longer life for cable or wire is provided by a larger size and machined drum barrel.

Tulsa's easily installed front mounted winches assure better weight distribution and steering for the vehicle — and safer off-highway operation — because there's a minimum of overhang.

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Philadelphia Electric has announced the appointment of **G. Earle Watt** as supervisor of residential lighting. Mr. Watt began his employment with the utility in 1949. He was named a retail sales representative in 1953, and later appointed application sales engineer.

* * *

The Virginia Electric and Power Company recently announced two personnel changes at Richmond. **Harrison Hubard,** operating engineer, system power supply department, was appointed district superintendent, distribution department. He will replace **Marion L. Simpson,** who was appointed manager of the motor vehicle department.

Carl D. Walbeck, junior engineer, system engineering and construction department, was appointed assistant to the system manager, transmission and distribution department. He replaces **C. F. Braunum,** who was appointed assistant transmission engineer, engineering and construction department.

* * *

Two top executive positions have been filled at Burroughs Corporation: **Henry F. Sherwood** is now special assistant to the vice president of marketing, and **Frank McKennett** is now consultant to the vice president of marketing.

Mr. Sherwood formerly was manager of the computer systems department of Touche, Ross, Bailey & Smart. Mr. McKennett was marketing consultant in the office of the IBM director of marketing services.

* * *

Carolina Power & Light Co. has named two new agricultural development engineers: at its Goldsboro District, **James Franklin Rogers** formerly farm supervisor for the N. C. Prison Department; at the utility's Sumter District, **Alva Wade Dickens Jr.,** formerly rural engineer for Georgia Power Co.

* * *

Ferol E. Betz has been named industrial relations manager for the Puget Sound Power & Light Co.

POLES

AMCRECO: Poles, crossarms, lumber. Pressure treated—All standard specifications. Stocks maintained. American Creosoting Corporation, 121 S. 5th St., Louisville 2, Ky.

College—

(Continued from page 66)

"My observations indicate favorable reactions from regulatory bodies, stockholders and customers of the utility industry's financial aid to non-tax-supported colleges through the broad-based State Association."

The president of VEPCO, too, is an enthusiastic supporter of the colleges. Recently A. H. McDowell said: ". . . We owe a great deal to our educational institutions. Without them we would not have skilled personnel to run our business. Private industry thus has a tremendous stake in the free private educational system; consequently, we recognize an obligation to defend, to promote, and sustain materially our free educational institutions so necessary to a free economic and political society."

Critics of "private power" interests might ask: Are there strings attached to this magnanimous giving? Hardly, in the past at least, if the experience of Prof. Hartung is typical. Here's what he reported from his experience in the VEPCO visit: "Throughout the fellowship I heard many references to the growing threat of public power . . . though prior to the fellowship I had little awareness of this threat, having heard little or nothing of this topic during ten years of teaching, reading and attendance at many annual economic conventions. . ."

But, the future might be different, especially if industry would take the advice of the Wheeling College professor: "Possibly this is so because the private power interests have presented their case so poorly, or not presented it at all. Industry could do a great deal more in the future in the battle against public power by sending speakers to colleges and universities, and by submitting papers to various economic and social science journals and publications."

Professor Hartung acknowledged the fact that utility sponsors of such fellowship studies "are trying to bring about a better understanding of the problems of business in free enterprise . . . expecting that when the professor returns to his classroom he takes with him many valuable points of appreciation and constructive criticism."

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Featuring New slotted Terminal Jaws permitting cooler operating temperatures. 4/0 Angle connectors—extra wide socket with choice of Hub Sizes. Either style available in any of three heights—9", 10½", or 12". Contains many new features. *Write for Bulletin #89*

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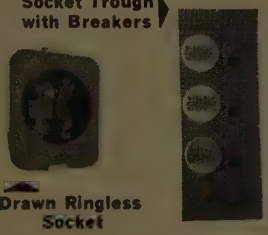

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Write for a free Catalog outlining types and sizes of meter socket equipment, test switches, test blocks, reactiformers and enclosures.

Regulatory—

(Continued from page 69)

Edison apparently attempts to relieve itself of responsibility by pointing out that our Secretary had engaged in correspondence with it in 1953 and 1954 and that the Commission had failed to take action or to require it to file rates. Of course, our not completing an investigation or taking action does not relieve Edison of the requirements of the Power Act. In fact, the correspondence was warning to it that the sale to Colton might be subject to our jurisdiction and that its rates and changes in them should be filed.

It is the contention of the company that the F. P. C. has no jurisdiction over the separately metered pumping load. Both the commission staff and Colton take the position that the F. P. C. has jurisdiction over all energy sold.

The commission's opinion noted that since there has been a separation of service between pumping and other energy sales to Colton both with respect to metering for such service and the use of separate rate schedules that:

". . a separation in fact is not only feasible but has been accomplished. Under United States v. Public Utility Comm'n., California Electric Power Co. v. F. P. C. and City of Hastings v. F. P. C., supra, there is no justification for our asserting jurisdiction in such a case over the separated non-jurisdictional transaction. We further find that if the question of separation had been properly presented by appropriate filings in 1954, the same conclusion should have been reached."

Accounting Rates and Refunds

The opinion noted that:

"The staff and Colton contend that Edison should have filed rates for its services to Colton and should now file the rates that were actually charged in 1954, namely those in the 1945 contract and should account for the difference between the 1945 contract rates and those actually charged. Edison contends that there is no overcharge since its charges have been in accordance with the contract as modified by the 1954 and 1957 orders of the PUC.

* * *

The record shows that from 1954, when the first PUC order purported to become effective, Edison has been charging rates that are higher than those specified in the 1945 contract. In these circumstances, it is appropriate to require that Edison establish in its books a special reserve account for the amounts collected in excess of the 1945 contract rate for the electric energy sold to Colton for resale, together with interest on such excess amounts, and require that Edison submit a proposed plan for the disposition of

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Cable splicing no longer need be one continuous operation when G&W Cable Nightcaps are used. Unfinished cable joints or terminations can be left overnight or for several days at a time with complete assurance that work will remain dry and clean as when sealed.

The G&W Cable Nightcap consists of a heavy plastic sleeve, waterproof paper to keep the plastic clean, tape, desiccant, and humidity indicator. The sleeve is slipped over the unfinished joint and one end taped tightly to the cable. Desiccant and humidity indicator are then inserted into the sleeve and its remaining end taped to the cable on other side of the joint. Waterproof paper is laid over the sleeve for protection.

Further information on the Cable Nightcap is available from G&W Electric Specialty Company or consult your local G&W representative.

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such special reserve. Wisconsin-Michigan Power Co. v. F. P. C., 197 F. 2d 472, certiorai denied 345 U. S. 934."

Conclusion

In its order the commission stated that the Edison Company make a transfer from account 216 unappropriated earned surplus to account 265 miscellaneous operating reserves for the amount of the excess charge plus interest at the rate of 6-percent for energy billed since July 1, 1954,

". . together with a proposed plan for the disposition of such special reserve; and serve such filing on all parties to this proceeding."

It is difficult to see how the Edison Company can show any plan as to the disposition of the amounts in the reserve until such time as the commission establishes that either the 1945 rate to Colton was just and reasonable or that the 1954 and 1957 rate increases were also just and reasonable. The F. P. C.'s action strongly suggests that the two increases were unreasonably high—an unlikely eventuality considering the past record of the California Public Utility Commission.

Unquestionably, this is a far-reaching decision and of major importance to all utilities that have "wholesale for resale" service. The question is how far will Federal jurisdiction extend itself and take precedence over State Commission action? It will be difficult with the present state of system interconnections for many companies to claim that they do not receive power in interstate commerce however insignificant such amounts may be as was in the case of the Southern California Edison Company.

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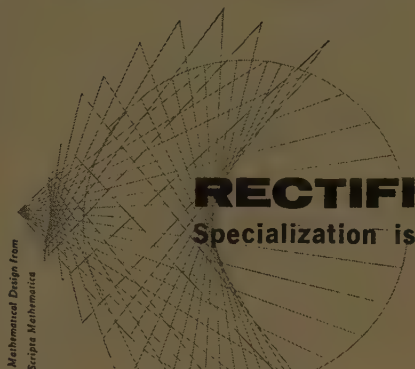

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RAPID makes *only* dc power supplies. This specialization enables you to buy from one source, from a manufacturer who designed and makes its own major components. Choose from a standard line of stock units from 5 Amperes 6 volts to 10,000 Amperes 50 Volts. Custom design is our specialty for higher voltages and KW ratings up to 1000. Our engineering staff and four manufacturing plants complete with the latest facilities are at your disposal.

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Now—Convert your own Reel Dolly to a Bullwheel Tensioner
WITH A
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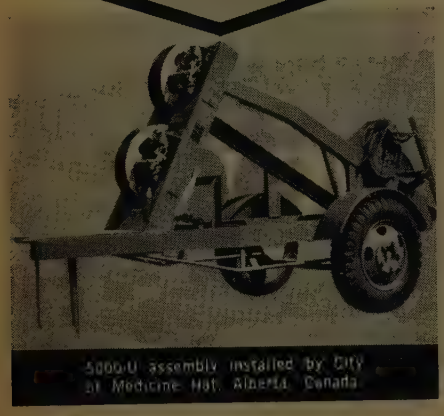
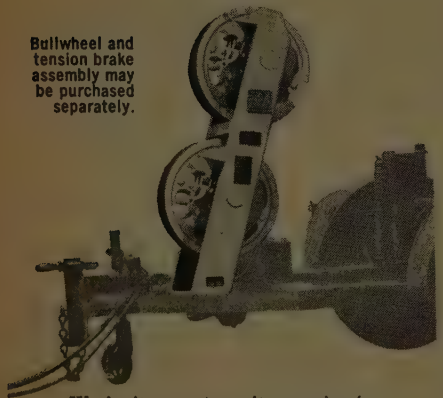


Here's an easy way to build up a modern bullwheel tensioner at low cost—simply install a PENGO 5000-U Bullwheel Assembly to your old trailer or reel dolly. You'll have a tensioner with Neoprene-lined 26" bullwheels, capable of handling practically any distribution line stringing job at tensions to 2,000 lbs. at up to 4 mph.

Support arms, reel spindle with reel brake, and hand rewind assembly. 2⅝" spindle will handle reels to 75" diameter, 44" width unless reduced to fit your trailer.

Bullwheel and tension brake assembly may be purchased separately.



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CABLE CAR IS SCHOOL BUS FOR CROSSING RIVER

One-quarter mile ride on electrically-operated cable car replaced 64-mile trip to school over rough roads.

WHAT price education? One might ask with good reason after observing the unique way the Dan and Leo Haughian families transport their children to school.

The Haughians live on a ranch about 30 miles east of Miles City, Mont., and until the transportation problem was solved the children had to travel 64 miles on rough roads to attend the nearest school.

But starting January, 1961, a cable car carries the children across the Yellowstone River to a convenient location on Highway 10. At that point they board a bus for Terry, where they now attend school.

The one-quarter mile trolley project was constructed by the Haughians at a cost of approximately $30,000. Towers on either side of the river anchor the main cable which is about one and one-fourth inches in diameter.

The cable car is round with glass windows on the upper portion and holds 10 children or six adults. Safety devices include a handrail around the inside of the car and a door which, when once locked, can't be opened until the car reaches either shore. Hand power can operate the car from the inside should the electric power fail when the car is in motion.

The car travels at a rate of about six feet per second and takes approximately four minutes to cross the Yellowstone. The tramway is powered by a three horsepower three-phase, 200-v variable speed motor.

Editor's Note: Information concerning the Haughian tramway was taken from an article which appeared in the Miles City Star, Miles City, Mont., and Montana-Dakota Utilities' "Mondakonian."

CONDUCTOR VIBRATION . . .

(Continued from page 61)

recorder, was 0.08 in., somewhat less than 10 percent of maximum amplitude recorded for the undamped span. The damper was effective over the entire range of wind velocities encountered during the test period.

It should be noted that use of a damper at only one end of a span is normally not recommended; in these tests the damper was not used at the recorder end of the span for experimental reasons.

Damper Application

Selection of damper sizes and best placement in spans are determined by conductor tension, weight, and diameter, and expected range of wind velocities. For spans of usual length, one damper is normally placed at each end of each span. For longer spans additional dampers are required.

On lines requiring dampers, or when it has been decided because of the importance of the line to use dampers as an extra precautionary measure, armor rods are not necessary. Armor rods do not provide additional vibration damping when dampers are used; and unless rod lengths are carefully selected, they can actually decrease effectiveness of dampers. While armor rods do protect conductors from flashover damage, protective equipment in use has practically eliminated this danger. Therefore, where flashover conditions are thus limited, cost of using dampers on a line can be largely offset by eliminating rods.

Bundled Conductors

Interest in extra-high-voltage transmission has caused a greater interest in bundled conductors. Alcoa's extended observations of bundled conductor construction with simultaneous vibration recordings from identical single conductors have revealed some interesting factors. Tests were made in spans varying from 700 to 1500 ft using two conductors spaced either 16 or 18 inches apart.

Undamped horizontal bundled conductors with spacers located at

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G&W Series 800 Fittings terminate, support, ground, mount, and dead end interlocked armor cable on the widest variety of applications. Four basic sizes accommodate all interlocked armor cable now available; eight different styles in each size accommodate the various types of installations. Ask your G&W Representative for the whole story on Series 800 Fittings, or send for free copy of Catalog H.

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3504 West 127th Street, Blue Island, Ill.
H60-2

customary 250 to 300-ft intervals will vibrate with less than half the amplitude of a single identical conductor in the same span. The leeward of the pair usually vibrates at a greater amplitude than the windward conductor. While spacers bring about a considerable reduction in amplitude of vibration, observation indicates that armor rods do not contribute as much additional damping as they do on a single conductor. Dampers, however, are as effective in controlling aeolian vibrations of bundled conductors as they are in controlling vibration of a single conductor in the same span.

TELLUROMETER SURVEY . . .

(Continued from page 64)

able to complete about 300 miles of line survey in a single day.

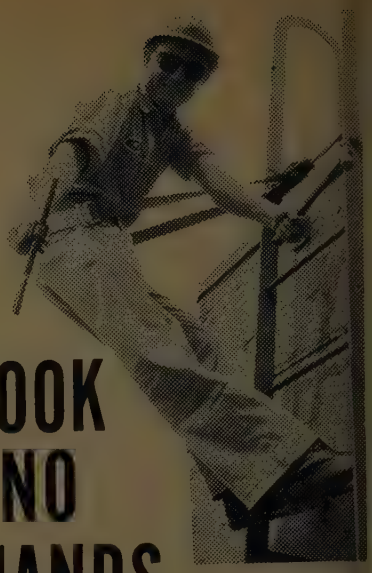
From start to finish the total survey job took only eight weeks. To get the same survey information by the usual methods would have required at least three months and cost three to four times as much.

To sum up, the performance of the Tellurometer method on the Alberta-to-California microwave survey proved very satisfactory, resulting in the production of an accurate survey in a short time and at low cost.

Other Advantages Foreseen

It may very well yield two other major advantages. One is that the Electrotape readings can be related to attenuation factor—that is, fade margins. Readings will be correlated against actual operating microwave systems to see whether they can help in the design of communications equipment.

Second, because the Tellurometer survey is so remarkably accurate over extremely long distances, its results may be used to develop a very accurate profile for the pipeline itself. In working up such a profile, use would also be made of geographic survey ties and available aero photos. If this is indeed a feasible application it would be a marked advance in developing pipeline profiles, which are vital to hydrostatic testing and to design and operational criteria.



LOOK NO HANDS

Makes ladder work *safe* with both hands free.

Safe-Hi LADDER CLIMBER

. . . fits the palm

. . . grips each rung as you climb.

Hold tight to rung by webbing attached to the safety belt.

wrist rescue belt

. . . will rescue worker through a small opening or over ledge without arm or shoulder injury even when unconscious. Maximum safety PLUS full freedom of movement while working.

ladder shoes

. . . hold ladder *safe* from slippage on wet or dry surface. Special spike for ice and snow.

ladder lash

. . . anchors ladder to pole or beam. POLE GRIP . . . steadies ladder against pole or corner of building.

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CALENDAR OF EVENTS

Sept. 20-21—EEI Street and Highway Lighting Committee Meeting, Buffalo, N. Y.

Sept. 20-21—P.I.P. Workshop Conference, Brown Palace Hotel, Denver, Colo.

Sept. 20-22—NELPA Annual Business Meeting, Sheraton-Portland Hotel, Portland, Ore.

Sept. 20-22—Annual National Electric Farm Power Conference, Leamington Hotel, Minneapolis, Minn.

Sept. 21-22—MVEA Accounting Conference, Sheraton-Jefferson Hotel, St. Louis, Mo.

Sept. 24-27—AIEE-ASME National Power Conference, St. Francis Hotel, San Francisco, Calif.

Sept. 24-29—National Technical Conference, Hotel Chase-Park Plaza, St. Louis, Mo.

Sept. 25-27 — EEI Meter and Service Committee Meeting, Leland Hotel, Springfield, Ill.

Sept. 25-27 — EEI Industrial Relations Roundtable Conference, Drake Hotel, Chicago, Ill.

Sept. 25-28—Industrial Building Exposition & Congress, New York Coliseum, New York, N. Y.

Sept. 27-28 — PEA Annual Meeting, Bellevue Stratford Hotel, Philadelphia, Pa.

Sept. 27-29—MVEA Sales, Rural & Home Service Conference, President Hotel, Kansas City, Mo.

Sept. 28-29 — SEE Accounting Section Conference, Atlanta Biltmore Hotel, Atlanta, Ga.

Oct. 2-3—Iowa Utilities Management Conference, Hotel Ft. Des Moines, Des Moines, Ia.

Oct. 2-3 — Tennessee Valley Public Power Association Power Use Section Meeting, Hotel Peabody, Memphis, Tenn.

Oct. 3-5—Lighting Progress Exposition, Hollywood Palladium, Los Angeles, Calif.

Oct. 4-6—26th Annual International Association of Electrical League Conference, The President Hotel, Atlantic City, N. J.

Oct. 4-6—52nd Annual Indiana Electric Association Convention, French Lick Springs Hotel, French Lick, Ind.

Oct. 5-6 — NPPA Accounting and Finance Section Workshop, Snohomish County PUD Auditorium, Everette, Wash.

Oct. 5-7 — ASME-AIME 24th Annual Joint Solid Fuels Conference, Dinkler-Tutwiler Hotel, Birmingham, Ala.

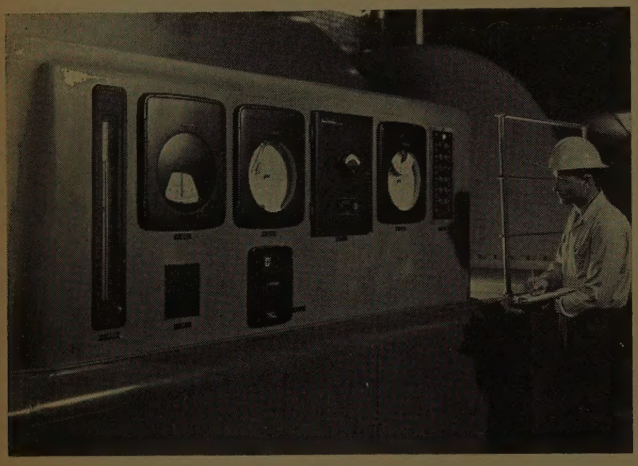
Oct. 26-27 — PCEA Hawaiian Conference, Princess Kaiulani Hotel, Honolulu, Hawaii.

INDEX TO ADVERTISERS

CIPS CO'S Meredosia Unit 3 Uses New Billboard Hydrogen Panel

A distinctive feature of Central Illinois Public Service's new Unit 3 at Meredosia, Ill. is the eye-level "billboard" hydrogen control panel on its 256-mva generator.

Although control-room-located-recorders for hydrogen are common, the distinctive and convenient panel at the generator, built by Allis-Chalmers, finds



its newest form in the "billboard" construction for the Meredosia unit.

Framed to the foundation on vibration isolators, the panel is also separated from contact with the unit apron. Gas control valves for use when needed are in the piping from the generator beneath the apron with flexible aircraft-type connections to instruments on the panel.

Compact Service Trucks Provide Greater Visibility and Accessibility . . .

Service vehicles of Niagara Mohawk Power Corp. are taking on a new look—and for good reason. They traveled a total of 3,300,000 miles during 1960 in response to calls from customers and to accomplish other routine assignments. This year, in anticipation of an increase in the 1,145,000 service calls of 1960, the utility has purchased 40 new service trucks of the compact variety, with an eye toward greater economy of operation and an increase in safety and efficiency.

Eventually, most of Niagara Mohawk's service trucks will be replaced by compact models according to Donald K. Wilson, system director of transportation for Niagara Mohawk. While the compact two-way radio equipped vehicles will be scrutinized carefully, Wilson is convinced that the new rigs will afford a considerable increase in gasoline mileage and a decrease in maintenance costs.

The new compacts offer at least two major advantages that are lacking in the other service trucks, according to Wilson; they are, much greater visibility and accessibility. Visibility has been increased by redesigning of service truck compartments. These compartments now are lower, allowing for unimpeded rear window vision and are more accessible.

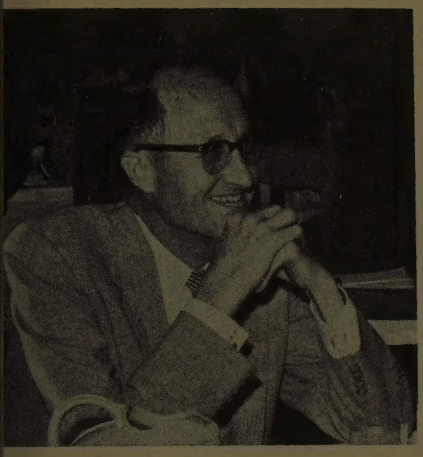
Helicopter Is Flying Ready-Mix Concrete Truck . . .

Faced with the task of erecting three 60-ft transmission towers in a mountain pass strewn with house-sized boulders, Southern California Edison Co. and its contractor, Owl Truck and Construction Co., turned a 1700-lb helicopter into a flying ready-mix concrete truck. As a result, all three towers were ready for line stringing in two days compared with original estimates of a week or two.

With formidable right-of-way in the distance Southern California Edison's Hiller 12E copter makes delivery of ready-mix concrete to tower sites a simple task. Canvas bag, designed by Owl Construction's engineering staff, weighs 63 lbs and was made of heavy canvas reinforced with steel cable and steel hoops at both ends. To keep up with copter's rapid work speed, three bags were made. While one was airborne, another could be washed and a third filled (on specially built wheeled racks) with up to five cubic ft of concrete.

Release is operated by ground crew only, but copter pilot could jettison bag and all by means of the Hiller's electrically-operated cargo release hook.

LIGHT AND POWER LINES



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THE MAGAZINE OF ELECTRIC • UTILITY TECHNOLOGY

The Outlook For Utility Construction In 1962—It appears now that in the coming year electric utilities across the nation will carry forward a new-construction program essentially the same as this year's program, in total dollar volume. However, early estimates indicate significant shifts in budget allocations for the general categories of generation; transmission; and distribution.

Based on estimates furnished EL&P by utilities with generating capability totalling 73.6 percent of the entire industry, generation expenditures will be down 9.7 percent in 1962 as compared with 1961, transmission expenditures will be up 6.0 percent and distribution expenditures will be up 6.3 percent.

The following tabulation compares the 1962 budget breakdown for this group of utilities with their revised totals for 1961:

Facilities	1961 Revised Budget	1962 Estimate
Generation	$1,201,644,915	$1,085,645,362
Transmission Lines	315,989,123	338,504,062
Transmission Subs	233,099,008	243,421,298
Distrib. Circuits	734,327,955	769,023,080
Rural Extensions	121,036,825	126,694,294
Distrib. Stations	182,767,433	208,083,280
General Plant	137,200,840	148,977,258

New data on 1961 construction expenditures have also been obtained as a check on budget figures furnished EL&P at the beginning of the year, and to permit comparison of actual expenditures during the first six months of 1961 and anticipated expenditures during the last six months. Utilities which provided updated figures on 1961 expenditures have generating capability totalling 81.3 percent of the entire industry.

As now reported, total 1961 new-construction expenditures by these respondent utilities are down 3.24 percent from the estimates they furnished EL&P at the beginning of the year. The previous budget total for this segment of the industry was $3,477,957,900. It is now $3,365,480,887.

Here is the categorical breakdown showing actual expenditures by these utilities during the first six months of 1961 and anticipated expenditures during the last six months:

1961 New-Construction Expenditures

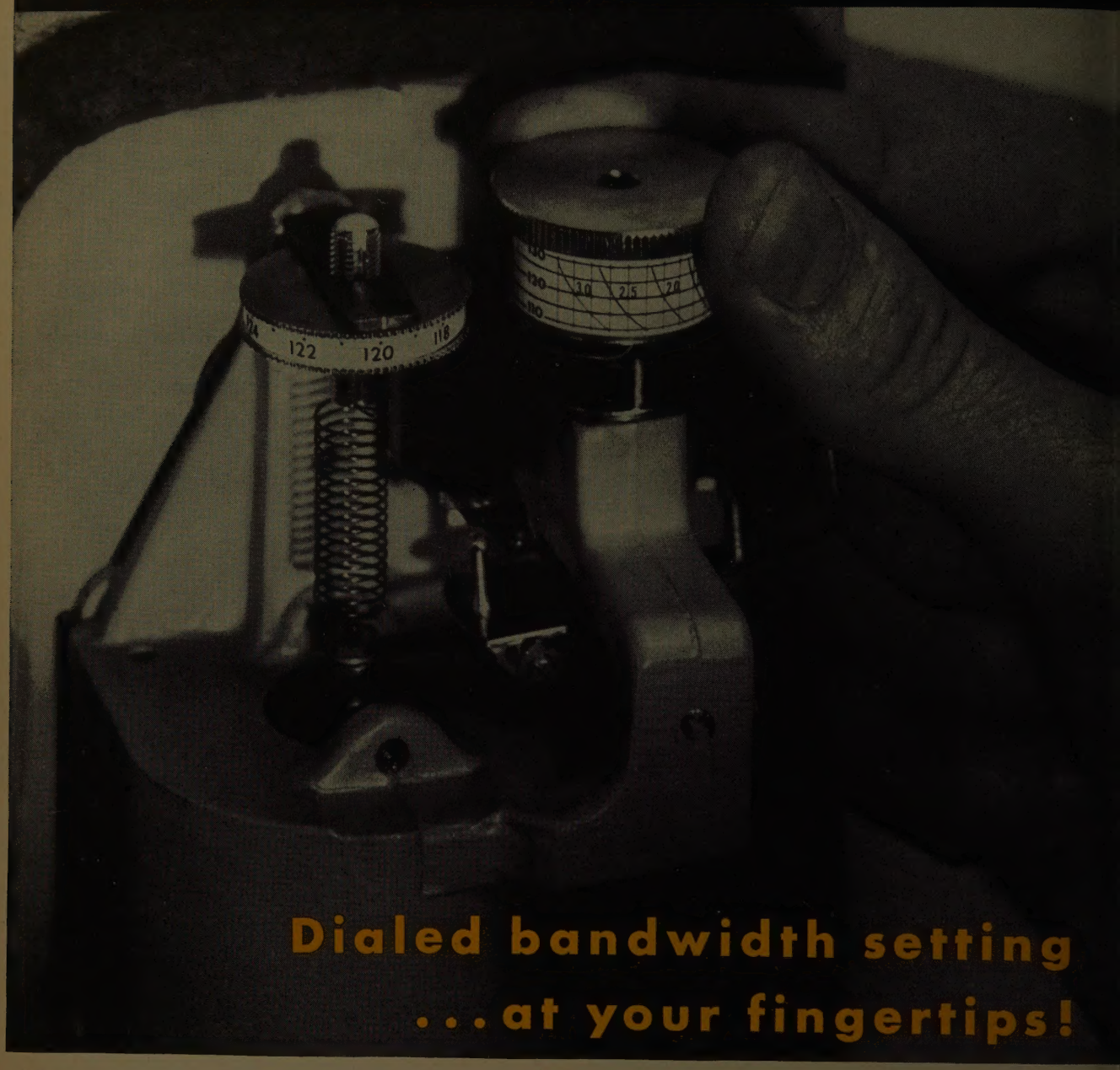
Facilities	Jan.-June	July-Dec.
Generation	$625,719,208	$697,523,250
Transmission Lines	141,233,004	228,462,617
Transmission Subs	120,797,953	157,655,592
Distrib. Circuits	400,511,240	445,693,477
Rural Extensions	74,569,801	88,737,742
Distrib. Stations	90,120,818	127,570,394
General Plant	66,160,341	100,725,450

Although the preliminary look at 1962 vs. 1961 new-construction expenditures by the electric utilities as given herein indicates near to a repeat performance over-all, it does provide assurance of a busy time ahead for both the utilities and their suppliers.

J. H. Garrett

Publisher and Editor

ANOTHER STEP AHEAD IN VOLTAGE REGULATION



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G-E Micro-Band* relay: first to permit fast, accurate setting of both regulator voltage level and bandwidth

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